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McDaniel (E. I.). **Long Spruce Gall** *Gillettea cooleyi* **Gill.**—*Quart. Bull. Mich. agric. Exp. Sta.* **16** no. 2 pp. 73–75, 1 fig., 1 ref. East Lansing, Mich., November 1933. [Recd. July 1934.]

Chermes (*Gillettea*) *cooleyi*, Gill., a native of the Rocky Mountain region, is now generally distributed throughout the United States wherever Colorado blue spruce [*Picea pungens*], Sitka spruce [*P. sitchensis*] or Engelmann's spruce [*P. engelmanni*] grows near Douglas fir [*Pseudotsuga taxifolia*]. During 1933, it was found for the first time in Michigan, as a pest of nurseries and ornamental plantings. An alternation of food-plants is apparently necessary, one season being spent on spruce, where large terminal galls are formed, each harbouring 12 or more individuals, and the next season on Douglas fir, where the Aphids live on the needles protected by wax-like filaments. A brief account of the life-history is given from the literature [*cf. R.A.E.*, A **3** 350; **4** 523; **10** 605; etc.]. Heavy infestation may destroy the entire new growth on the trees, especially spruce.

For control, it is recommended to grow spruce as far as possible from Douglas fir and to clip off the galls on small nursery stock or young trees and burn them in June or July before the Aphids emerge. Good results may be obtained by spraying dormant spruce or Douglas fir in spring with a miscible oil emulsion (1 : 30) at high pressure, the tips of the twigs being thoroughly covered. The midsummer generation may be controlled by a spray of ½ gal. summer oil, 1 pint nicotine sulphate and 100 gals. water. Oil sprays [*cf.* **21** 316] should not be used where the temperature may drop below 40 or 45°F. before the tree dries, as the oil will freeze. In midsummer it is necessary to avoid high temperatures; above 85°F., the tree will be scorched before it dries.

Hutson (R.). **Pyrethrum controls Cabbage Worms.**—*Quart. Bull. Mich. agric. Exp. Sta.* **16** no. 2 pp. 100–101. East Lansing, Mich., November 1933. [Recd. July 1934.]

Effective control of the larvae of the cabbage butterfly [*Pieris*] in Michigan was obtained by dusting the cabbages with one part of ground pyrethrum flowers (or their active principle) with two parts of some inert carrier at the rate of 25–30 lb. to the acre. The addition of ½ U.S. gallon of kerosene to 100 lb. dust increased the effectiveness. Pyrethrum sprays were less effective, chiefly on account of poor coverage.

McDaniel (E. I.). **Control of Insects infesting stored Food Products in the Home.**—*Quart. Bull. Mich. agric. Exp. Sta.* **16** no. 3 pp. 167–173, 7 figs. East Lansing, Mich., February 1934. [Recd. July 1934.]

Brief notes are given on the bionomics and control of 16 common species of insects infesting stored products in the United States.

Hutson (R.). **Avoiding Residue in controlling Raspberry Beetle and Saw-fly.**—*Quart. Bull. Mich. agric. Exp. Sta.* **16** no. 3 pp. 183–185, 2 figs. East Lansing, Mich., February 1934. [Recd. July 1934.]

Serious damage to raspberries in Michigan is sometimes caused by *Byturus unicolor*, Say (American raspberry beetle), and *Monophadnus*

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(*Monophadnoides*) *rubi*, Harr. (raspberry sawfly). Brief notes are given on their bionomics [*cf. R.A.E.*, A **18** 542 ; **9** 238]. Against the adults of the Byturid, which appear on the bushes before they bloom, an arsenical may be added at the rate of 3 lb. to 100 U.S. gals. of the spray normally applied at that time, or a dust of calcium arsenate and lime (1 : 19) may be applied (at a rate of about 30 lb. to the acre for a single application) at the time when the flower-buds are appearing. When the larvae of the sawfly appear before the fruit sets, they may be controlled by an arsenical spray [*cf.* **11** 447] ; after the fruit has set, sprays of derris or pyrethrum should be used.

HUTSON (R.). **Pyrethrum and Derris Insecticides as Arsenical Substitutes.**—*Quart. Bull. Mich. agric. Exp. Sta.* **16** no. 4 pp. 241–242. East Lansing, Mich., May 1934.

Derris and pyrethrum appear to be the most promising of the insecticides that are not poisonous to man or higher animals, and their cost does not greatly exceed that of arsenicals or fluorine compounds. Usually they are more effective as dusts, but where power sprayers are used, the liquids give the better control. A formula effective against caterpillars on vegetables consists of 5 qts. 40 per cent. potassium oleate soap and $\frac{3}{4}$ pint 20-fold water-miscible extract of pyrethrum in 100 gals. spray. Cabbage worms [*Pieris*] and currant worms [*Pteronus ribesii*, Scop.] may be destroyed by a dust containing 40 per cent. of finely ground flowers of pyrethrum with an inert carrier. A good derris spray can be made with 1 U.S. qt. of the acetone extract (containing 5 per cent. rotenone) mixed with 1 lb. of powdered skimmed milk (or 2 U.S. gals. skimmed milk) in 100 U.S. gals. water, an alternative spreader being 5 U.S. qts. of 40 per cent. potassium oleate soap. Usually, 100–150 U.S. gals. of spray, or 25–35 lb. of dust, are required per acre.

MCDANIEL (E. I.). **The principal Insect Pests of Juniper in Michigan.**—*Quart. Bull. Mich. agric. Exp. Sta.* **16** no. 4 pp. 244–246. East Lansing, Mich., May 1934.

Dichomeris (*Ypsolophus*) *marginella*, F. (juniper webworm), the most injurious insect pest of juniper, has one generation a year in Michigan, where it is not common. The moths appear in June and oviposit on the new growth [*cf. R.A.E.*, A **10** 279]. The larvae live and hibernate in communal nests made of dead leaves and enclosed in tough silken webs. On small trees, pruning and destruction of all nests late in autumn or early in spring may check light infestations. In large plantings, spraying in mid-June with lead arsenate (3 lb. to 100 U.S. gals., with 3–4 lb. flour as a sticker) is recommended. After the webs are formed, nicotine sulphate or pyrethrum applied at high pressure will give some control.

Lachnus sabinae, Gill., attacks the smaller twigs and branches of juniper. Infestation, which greatly weakens the trees, may be detected by the presence of ants that are attracted to the honey-dew, on which grows a sooty mould. It only takes place early in the season, as the Aphids migrate in late spring to the summer food-plant. The trees may be sprayed with pyrethrum or derris or 1 U.S. pint nicotine sulphate and 4 lb. soap to 100 U.S. gals. water. Where the spray is applied at low pressure, one tablespoonful of nicotine sulphate must be used to each U.S. gallon of hot soap suds.

Diaspis visci, Schr. (*carueli*, Targ.), which besides juniper also infests arborvitae [*Thuja*], is often confined to individual branches, and if abundant, may kill isolated limbs or sometimes entire trees. There appears to be only one generation a year in Michigan. The female scale hibernates when almost mature, and the young appear on the foliage in June. This Coccid can be safely controlled by a mineral oil (of at least 100 seconds viscosity and 70 per cent. unsulphonated residue) diluted 1 : 30 or 1 : 35 and sprayed in spring before the growth starts, provided that there is no danger of the temperature falling below 40°F. before the spray dries.

Phloeosinus dentatus, Say, which is primarily a pest of ornamental conifers and does not occur in forests, is particularly troublesome on juniper in dry seasons, attacking recently transplanted, sickly or dying trees, especially those that have been weakened by *Lachnus* or *Diaspis*. A characteristic tunnel is made in the cambium ; the egg-gallery extends 1–2 ins. up from the entrance chamber, and the larvae leave it at right angles, but later tunnel upwards or downwards. Recently transplanted trees should be watered and cultivated, in order to increase their resistance [*cf.* **19** 486], and infested ones should be removed.

Paratetranychus spp. on juniper can be controlled by the oil spray recommended against *Diaspis*. Against *Tetranychus telarius*, L. (*bimaculatus*, Harv.), which migrates to juniper, a summer spray of 1½ lb. glue in 10 U.S. gals. water is effective.

Hopping (G. R.) & Jenkins (J. H.). **The Effect of Kiln Temperatures and Air-seasoning on Ambrosia Insects (Pinworms).**—*Circ. For. Serv. Dep. Int. Canada* no. 38, 14 pp., 6 figs., 1 graph. Ottawa, 1933. [Recd. October 1934.]

Details are given of experiments carried out in 1932 on the control of three species of Scolytids that attack freshly cut timber of western hemlock [*Tsuga heterophylla*] in British Columbia. All stages are briefly described. The adults appear during late April and early May and bore straight through the bark into the sap-wood of logs or large branches that have been cut for a sufficiently long period to produce the sap condition necessary for the growth of the ambrosia fungus on which the larvae feed. Healthy living trees and seasoned timber are not attacked. *Xyleborus* (*Xyleborinus*) sp. deposits its eggs free in the gallery, but *Xyloterus* (*Trypodendron*) *cavifrons*, Mannh., and *Gnathotrichus sulcatus*, Lec., do so in niches cut in the sides of the tunnel, usually one egg to a niche [*cf. R.A.E.*, A **18** 209] ; the larvae develop and pupate in these niches, which are gradually enlarged into small lateral cells, and the young beetles emerge before autumn into the main tunnel, whence they make their way out through the entrance hole. Apparently they begin to make egg galleries within a short period after emergence, thus originating the second attack of the year.

The following is taken from the authors' summary and conclusions : In pieces of western hemlock 3 ins. thick subjected to kiln temperatures at a constant relative humidity of 80 per cent., all the Scolytids were dead after 1½ hours at 150°F., 2½ hours at 140°F. or 9 at 120°F. In 29 similar pieces subjected to air seasoning, only 290 examples of the Scolytids were found after 86 days (during which the average moisture content had been reduced from 62·9 to 21·8 per cent.), whereas 18 control pieces previously examined contained 1,519 living and 8 dead

ones. This showed that the majority had emerged as adults during the seasoning process, though there was a high mortality among the young larvae, which could be attributed to its effect. A small amount of parasitism by a Hymenopteron was noted in both the kiln-treated and the air-seasoned timber, but not enough to reduce the numbers appreciably. It is concluded that kiln treatment is a commercially applicable method for killing all insects in green timber 3 ins. thick or less, without appreciably altering its moisture condition or affecting its quality. Air-seasoning, if continued long enough, will eventually eliminate, either by death or by emergence, all living insects of the species dealt with. This method cannot be recommended, however, where their total destruction in a short period is required.

MACKIE (D. B.). [Annual Report of the Division of] **Entomology.**—*Mon. Bull. Dep. Agric. Calif.* **22** (1933) no. 12 pp. 457–472. Sacramento, Calif., 1934.

In California, unusually low temperatures in the middle of December 1932, which caused the complete defoliation of *Citrus* over large areas, practically prevented the occurrence of undetected infestations by the citrus whitefly [*Dialeurodes citri*, R. & H.]. A slight extension of the infested area occurred in one locality in Los Angeles County [*cf. R.A.E.*, A **21** 516]. Examination of *Citrus* fruit from groves infested with *Scirtothrips citri*, Moult., showed the lowest infestation (1·7 per cent. of damaged fruit) to be in those that had been winter-sprayed with lime-sulphur. An estimation of the effectiveness of dusting with sulphur against *Saissetia oleae*, Bern., in orange groves when the young scales were in the crawling stage showed that the kill is dependent on factors beyond the control of man, such as evenness of hatch, wind conditions and temperatures. *Coccus pseudomagnoliarum*, Kuw., on *Citrus* was successfully controlled by the application in February of a spray containing 4 per cent. liquid lime-sulphur.

Lack of control measures and orchard sanitation, due to extremely low prices, led to the heaviest infestation of pear and apple by *Cydia* (*Carpocapsa*) *pomonella*, L., for two decades and a marked increase of *Aspidiotus perniciosus*, Comst. (as shown by inspection of 50 deciduous orchards in three counties). Considerable injury to Quetta nectarine was caused by four species of *Frankliniella*, which enter the blossoms and feed on the embryo fruit, causing it to be scarred and of inferior grade. Observations have indicated that treatment with an insecticide is necessary when damage to young nectarines approaches 10–12 per cent.; if 20 per cent. of the young fruit are injured, heavy commercial damage to the mature fruit may be expected. *Tetranychus telarius*, L., and *T. pacificus*, McG., have been increasingly injurious in the Sacramento Valley fruit districts, especially to prune and almond.

The grape leafhopper [*Erythroneura comes*, Say] continued to be the chief vine pest; calcium cyanide dust and nicotine were the principal insecticides used in control, with pyrethrum and oil in the earlier part of the season [*cf.* **21** 589]. Grasshoppers did considerable damage in a number of counties, chiefly to lucerne and cotton. The European earwig [*Forficula auricularia*, L.] was discovered in a lucerne patch in one district. The bean thrips [*Hercothrips fasciatus*, Perg.] caused considerable loss to bean growers in the San Joaquin Valley.

The elm leaf-beetle [*Galerucella luteola*, Müll.] continued to spread [*cf.* **22** 156], and a new type of gun has been designed to allow the

application of sprays to high trees. The European elm scale [*Gossyparia spuria*, Mod.], which also caused much trouble, was successfully controlled by a spray containing 5 per cent. dormant oil emulsion and 5 per cent. lime-sulphur solution, but the deleterious action of the spray on paint precludes its use in residential districts. The plane tree scale [*Stomacoccus platani*, Ferris], a comparatively new pest [*cf.* **18** 709], proved hard to control, owing to its habit of migrating into fissures and the protracted period of hatching, which is extended over three months. In March, a well-established infestation of the obscure scale [*Chrysomphalus obscurus*, Comst.], which is the most serious Coccid pest of nuts in the southern States but had not previously been taken in California outside a quarantine station, was discovered in one locality. About 25 acres of walnuts, pecan and stone fruit trees were involved. Spraying with a 4 per cent. tank-mix type of 100-second viscosity oil gave excellent results. *Aspidiotus degeneratus*, Leon., which is causing some damage in southern California, was found to be fairly common on *Camellia* in the Sacramento district.

Cherries infested with *Rhagoletis* sp. were found in the north, this representing the first positive finding of a cherry fruit-fly in California. A survey of the district, including a large area of wild *Prunus*, and a careful inspection and sifting of the soil under the infested trees revealed no further examples of the fly.

FLEURY (A. C.). [Annual Report of the] **Bureau of Plant Quarantine.**—*Mon. Bull. Dep. Agric. Calif.* **22** (1933) no. 12 pp. 526–535. Sacramento, Calif., 1934.

Pests intercepted in California during 1933 in the course of quarantine inspection at major ports included, besides a few species mentioned in previous reports [*R.A.E.*, A **20** 586; **21** 517]: *Ceratitis capitata*, Wied., in coffee berries and mangos from Hawaii; *Platyedra* (*Pectinophora*) *gossypiella*, Saund., in cotton from India; *Pyrausta nubilalis*, Hb., in green maize from Japan; *Anthonomus grandis*, Boh., in seed cotton from Virginia; eggs of *Leptinotarsa decemlineata*, Say, on tomato plants from Texas; *Rhagoletis cingulata*, Lw., in cherries from Oregon; *Anastrepha* sp. and *A. serpentina*, Wied., in a cargo hold in which bananas from Central America had been transported; *Dialeurodes citri*, R. & H., on ornamental plants from Japan and the Orient; *Cydia* (*Laspeyresia*) *splendana*, Hb., in chestnuts from Russia, Japan, Italy, France and Switzerland; *Hypera* (*Phytonomus*) *nigrirostris*, F., on nursery stock from Oregon; weevils of the genus *Curculio* in chestnuts from Japan, Italy, France and Switzerland, acorns from Japan and Manchuria, and pecan nuts from Texas; *Eumerus tuberculatus*, Rond., in narcissus from Washington and Oregon; and *Enarmonia* (*Grapholitha*) *prunivora*, Walsh, in apples from Iowa and New York.

PARKER (R. L.) & LAMERSON (P. G.). **Hymenopterous Parasites of the Western Apple Curculio in northeastern Kansas** (*Tachypterellus quadrigibbus magnus* **List, Coleoptera, Curculionidae).**—*J. Kansas ent. Soc.* **7** no. 3 pp. 90–95, 10 refs. McPherson, Kans., July 1934.

In the course of studies on *Tachypterellus quadrigibbus magnus*, List [*R.A.E.*, A **20** 703] in Kansas during 1932–33, over half the parasitism observed was due to *Eurytoma tylodermatis*, Ashm., and about 40 per cent. to *Microbracon tachypteri*, Mues. Of *M. variabilis*, Prov., only 3 examples were obtained. The larvae of *E. tylodermatis*, which is

recorded from at least ten different hosts in the United States, chiefly attacked the larvae of the host, but occasionally the pupae and dead adults, feeding on them externally. They pupated in the cavity in the apple hollowed out by the feeding of the grub. *M. tachypteri*, which was only observed feeding on already dead larvae, pupated in a tough parchment-like cocoon, as did also *M. variabilis*. The degree of parasitism in orchards appeared to vary in inverse proportion to the amount of cover beneath the trees, reaching as high as 33 per cent. in apples from areas clear of grass or weeds. These parasites cannot be relied upon to exercise satisfactory control of the weevil. In 1932, their activity only started after most of the damage had been done.

GARMAN (P.). **Control of the Plum Curculio on Fruit Trees.**—*Circ. Conn. agric. Exp. Sta.* no. 99 pp. 47–53, 9 figs. New Haven, Conn., March 1934. [Recd. August 1934.]

An account is given of the bionomics of *Conotrachelus nenuphar*, Hbst., in Connecticut [*cf. R.A.E.*, A **14** 442 ; **15** 263 ; **17** 525], and the following programmes are recommended :—Apples should be treated with a calyx spray and at least 2 subsequent applications at intervals of 7–10 days of 3 lb. lead arsenate (or a special curculio spray of 3–4 lb. lead arsenate, 10 lb. lime and 1 U.S. qt. fish or linseed oil) in 100 U.S. gals. On varieties affected by scab, the latter mixture should only be applied in the first cover spray, lead arsenate with the usual fungicide being used for the other ones. On peaches, where infestation is heavy or a light crop requires protection, 3 lb. lead arsenate, 4 lb. zinc sulphate, 4 lb. hydrated lime and a wettable sulphur in 100 U.S. gals. may be applied as the shucks are being pushed off the young fruit and again 10–14 days later. Plums may be sprayed with 2 lb. lead arsenate, 4 lb. hydrated lime and a wettable sulphur in 100 U.S. gals. when they are the size of peas, or when the first oviposition punctures appear, and again after 10–14 days. A spray of 3 lb. lead arsenate and a wettable sulphur may be used on pear at the calyx period and again after 10–14 days, and on cherry after petal-fall and again after 14 days.

GARMAN (P.) & TURNER (N.). **Substitutes for Lead Arsenate on Fruits and Vegetables in Connecticut.**—*Circ. Conn. agric. Exp. Sta.* no. 100 pp. 55–58. New Haven, Conn., March 1934. [Recd. August 1934.]

General recommendations are made for the application of lead arsenate and of other less poisonous materials against pests of fruit trees, bush fruits and vegetables in Connecticut, where, however, the danger of poisonous residues is less serious than elsewhere owing to the more abundant rainfall before harvest.

GARMAN (P.). **Control of Apple Maggot.**—*Circ. Conn. agric. Exp. Sta.* no. 101 pp. 59–63, 6 figs. New Haven, Conn., April 1934. [Recd. August 1934.]

An account is given of the bionomics of *Rhagoletis pomonella*, Walsh, on apple in Connecticut [*cf. R.A.E.*, A **16** 568 ; etc.]. Eggs and young larvae may be killed in infested fruit by cold storage for one month [**19** 545 ; **21** 460]. Summer and early autumn varieties should be dusted with lime and calcium arsenate (90 : 10) or sulphur, lime and lead arsenate (80 : 10 : 10), or sprayed with 2 lb. calcium arsenate and 6–8 lb. hydrated lime in 100 U.S. gals. water when the fruit ripens late

enough to allow 2 months between the last application and harvest. Treatments may be applied during the first week in July and again about 20th July ; the second can probably be omitted in light infestations. Late autumn and winter varieties may be sprayed with 3 lb. lead arsenate in 100 U.S gals. at the same times, though a third application of 2 lb. lead arsenate or a dust of sulphur, lime and lead arsenate may be necessary, the latter being preferable in dry seasons. A single application during 6th–10th July is sufficient for light infestations.

Britton (W. E.). **Laws and Regulations concerning the Inspection and Shipment of Nursery Stock in Connecticut.**—*Circ. Conn. agric. Exp. Sta.* no. 103 pp. 75–77. New Haven, Conn., July 1934. **Quarantine Measures restricting Shipments of Connecticut Plants 1934.**—*Op. cit* no. 104 pp. 78–82. **Regulations concerning Transportation of Nursery Stock in the United States and Canada.**—*Op. cit.* no. 105 pp. 83–108.

The first of these circulars gives the terms of the law of 1925 as revised in 1930 governing the inspection of nursery stock imported into Connecticut or grown in that State for local sale or export. The second enumerates the Federal quarantines that affect the shipment of plants from Connecticut. The third is intended to bring together in tabular form the various regulations by which Connecticut nurserymen may be affected when desirous of exporting produce to other States. A digest of the Federal quarantines affecting the transport of nursery stock is also included, together with the regulations of the District of Columbia and the Dominion of Canada.

Chapman (P. J.) & Hammer (O. H.). **A Study of Apple Maggot Control Measures.**—*Bull. N.Y. St. agric. Exp. Sta.* no. 644, 40 pp., 17 figs., 12 refs. Geneva, N.Y., May 1934.

Investigations in New York during 1930–33 on the control of *Rhagoletis pomonella*, Walsh [*R.A.E.*, A **20** 360 ; **21** 460 ; etc.] showed that, for entirely satisfactory control, 3 lb. lead arsenate to 100 U.S. gals. water should be applied fortnightly against the adults from about 10th–15th June to about 20th August. This treatment is employed in many apple orchards against the codling moth [*Cydia pomonella*, L.] and generally ensures almost complete freedom from infestation by *Rhagoletis*. Even in orchards that are extremely heavily infested or where the conditions are adverse, 90–95 per cent. of the fruit may eventually be free from oviposition punctures, though more than one season's spraying is often necessary to obtain commercial control. Two applications of this spray appeared to give good control of this or an allied Trypetid on plums.

Calcium arsenate is less adhesive than lead arsenate [**22** 406] and less toxic to *Cydia*, and it may cause injury to the fruit and foliage. Synthetic and natural cryolite and manganese arsenate have given promising results, though they are inferior to lead arsenate.

Runnels (H. A.) & Wilson (J. D.). **The Influence of Certain Spray Materials, Herbicides, and other Compounds on the Desiccation of Plant Tissue.**—*Bi-m. Bull. Ohio agric. Exp. Sta.* **19** no. 168 pp. 104–109, 9 refs. Wooster, Ohio, 1934.

The following is based on the author's summary : Bordeaux mixture (4 : 6 : 50) alone increased the rate of desiccation of shoots of various plants, but when mixed (1 : 1) with 1 per cent. oil emulsion (which by

itself decreased the rate of desiccation) it had little effect. Transplanted tomato and cucumber plants sprayed with oil emulsion survived in about the same proportion as untreated ones, whereas the Bordeaux spray killed most of them. Strong Bordeaux mixtures were more injurious than weak ones, and neither the hydrated lime nor the copper sulphate constituent used separately was as potent as the mixture. A Bordeaux mixture made by adding copper sulphate to lime had a more drying effect than one made by the reverse method. Of several strengths of Bordeaux mixture tried, the 4 : 6 : 50 formula caused the greatest rate of desiccation. The addition (at the rate of 1 lb. to 50 U.S. gals.) of several spreaders and stickers increased the injurious effect, whereas that of lead or calcium arsenate or other insecticides did not. Sulphur sprays only caused a slight increase in the rate of tissue drying, whereas a number of oil-containing compounds decreased it 4–16 per cent. Ferrous sulphate added to hydrated lime increased desiccation more than copper sulphate, but zinc sulphate had less effect. Among other copper compounds tested, copper chloride was the only one to cause a greater rate of drying of *Coleus* leaves than copper sulphate. Of sodium compounds, the chlorate and the sulphite were particularly potent. Of several herbicides, sodium arsenite had the greatest desiccating effect and ferrous sulphate the least.

Entomology.—*Bull. Ohio agric. Exp. Sta.* no. 532 (Rep. 1932–33) pp. 39–46, 2 figs. Wooster, Ohio, February 1934. [Recd. July 1934.]

During work in Ohio in the year ending June 1933, H. L. Gui found that, in a spray of Bordeaux mixture (4 : 6 : 50) applied weekly to potato, 2 lb. calcium arsenate in 50 U.S. gals. was more efficient against *Epitrix cucumeris*, Harris, than 2 lb. lead arsenate [*cf. R.A.E.*, A **22** 281]. The omission of the first or the last four (out of eight) weekly applications, or of alternate ones, reduced the yield.

In studies on *Taeniothrips gladioli*, Moult. & Stnw., E. A. Herr showed that the thrips did not develop in gladiolus corms stored at temperatures below 50°F.; at 86, 77, 68 and 59°F., an entire generation lasted 10, 12, 23 and 43 days respectively. In the field, a spray of ½ lb. Paris green and 33 lb. brown sugar in 50 U.S. gals. water [*cf.* **21** 466] applied when the plants were six inches high and followed by six treatments at weekly intervals gave the best control.

Observations by J. P. Sleesman showed that onions varied in their susceptibility to infestation by *Hylemyia antiqua*, Mg., and *Thrips tabaci*, Lind., Sweet Spanish being the most resistant to both. A proprietary emulsified tar acid oil (1·5 per cent.) gave 91·1 per cent. control of the thrips.

A severe outbreak of *Blissus leucopterus*, Say, on cereals created a demand for a cheaper material than creosote for use in protective barriers [*cf.* **14** 166]. L. L. Huber and J. S. Houser found that it may be diluted from half to two-thirds with crude oil and still be fairly effective.

R. B. Neiswander reports that weekly records over several years show a growing tendency for the numbers of *Cydia* (*Grapholitha*) *molesta*, Busck, on peach to increase early in the season and later to decrease, probably owing to parasites. The degree of parasitism in various parts of the State is considered; it reached 72 per cent. in the south, where *Macrocentrus delicatus*, Cress., predominated. In the north, where the introduced species, *M. ancylivora*, Roh., has become

abundant, infestation was relatively light. Of sprays tested, oil with either nicotine or rotenone gave a reduction of 36·1 per cent. in injury when applied six times at weekly intervals from 21st July; there were indications that greater control would have been obtained if the first spray had been applied 2 weeks earlier.

Of five arsenicals used in combination with five fungicides in experiments carried out by C. R. Cutright against *C.* (*Carpocapsa*) *pomonella*, L., on apples, lead and magnesium arsenate were the least injurious to the trees, the latter, however, giving the poorest control, and of the fungicides, Bordeaux mixture (1 : 3 : 50) and lime-sulphur-lime were the most satisfactory [**22** 406]. Of the non-arsenical substitutes used in midsummer, natural cryolite was the most effective, barium fluosilicate and nicotine being slightly less so, whereas nicotine tannate was the least. In four out of six orchards where beta-naphthol bands were used, infestation markedly increased; in the other two, in which it decreased, extra sprays had been applied. *Anuraphis* (*Aphis*) *roseus*, Bak., was injurious to apple over a wide area. Infestation on trees treated with lime-sulphur and nicotine sulphate and with 2 per cent. oil and ½ per cent. cresylic acid was 0·75 and 3 per cent., respectively, as compared with 21 per cent. on unsprayed trees.

L. L. Huber, J. B. Polivka and J. R. Savage found that early maturing varieties of maize were less susceptible to attack by *Heliothis obsoleta*, F., than late maturing ones. Undiluted calcium arsenate, lead arsenate and flour (2 : 1), and barium fluosilicate and flour (1 : 4) were used in experiments this year; the first scorched the silks and husks severely, and the other two each gave about 50 per cent. control, but were also slightly injurious.

Houser (J. S.). **General Review of the Codling Moth Situation.**—*Proc. Ohio St. hort. Soc.* **67** pp. 90–96. Columbus, Ohio, 1934.

The recent rapid increase of the codling moth [*Cydia pomonella*, L.] in Ohio is ascribed to a combination of factors, including a development of resistance to arsenic, unusually favourable weather and the comparative rarity of a total apple crop failure. Until a satisfactory substitute for lead arsenate can be found, it will be necessary to wash the fruit.

Cutright (C. R.). **The Experimental Program against Codling Moth in 1933.**—*Proc. Ohio St. hort. Soc.* **67** pp. 96–103, 1 chart. Columbus, Ohio, 1934.

As records of the appearance of injuries on apples in Ohio have shown that the individual female codling moth [*Cydia pomonella*, L.] oviposits over a period possibly as long as two weeks, spray programmes based on captures of moths in bait-pails or emergence in field cages may often prove inadequate. The uncertain results obtained with banding [*cf.* above] showed that this cannot safely replace spraying. Of various substitutes for lead arsenate tested, zinc and manganese arsenate were the best, but none was completely satisfactory. Nicotine-oil was very effective for a short period, but had no lasting effect.

Hough (W. S.). **Experiences in Removal of Arsenical and Lead Spray Residues.**—*Proc. Ohio St. hort. Soc.* **67** pp. 104–109. Columbus, Ohio, 1934.

The results of washing apples with hydrochloric acid and a wetting agent (Vatsol or Aresco) to remove arsenical and lead residues after

various spray treatments in Ohio in 1933 are tabulated. The use of lime or Bordeaux mixture with the lead arsenate spray aided residue removal. A colloidal spreader made from soy-bean flour did not appear to complicate it, but casein spreaders (including powdered skim milk) definitely increased the difficulty of removal, as did the addition of summer oil or letting the fruit stand for three weeks before washing. It is unnecessary to have more than 4½ gals. HCl per 100 gals. solution.

BALLOU (F. H.). **Spraying Methods that insure safe and thorough Coverage.**—*Proc. Ohio St. hort. Soc.* **67** pp. 109–118. Columbus, Ohio, 1934.

Developments in fruit tree spraying in Ohio during the past forty years and the best ways of utilising modern equipment are briefly discussed.

GREENE (C. T.). **A Revision of the Genus *Anastrepha* based on a Study of the Wings and on the Length of the Ovipositor Sheath (Diptera : Trypetidae).**—*Proc. ent. Soc. Wash.* **36** no. 6 pp. 127–179, 5 pls., 4 figs., 36 refs. Washington, D.C., June 1934.

In view of the establishment of quarantine regulations against fruit-flies in the United States, keys are given to the adults of both sexes of 54 species of *Anastrepha* (natives of South or Central America or the West Indies) represented in the U.S. National Museum, with notes on their recorded distribution and food-plants. *A. unipuncta*, Seín [*R.A.E.*, A **22** 151] is considered to be synonymous with *A. suspensa*, Lw., and *A. fraterculus* var. *mombinpraeoptans*, Seín [*loc. cit.*] with *A. acidusa*, Wlk. *A. peruviana*, Tns., which has been considered a synonym of *A. fraterculus*, Wied., by some workers, is stated to be a distinct species ; it occurs in Peru, Chile, and Brazil, attacking peach and *Anona cherimolia*. *A. fraterculus*, which has been reared from *Inga* and grapefruit, is recorded from Brazil, Trinidad, Costa Rica and Guatemala. The common species in the West Indies is *A. acidusa* [*cf.* **22** 26; 221], which is widely distributed there; it has been reared from *Spondias* spp., *Eugenia jambos*, mango and guava.

The 16 new species here described include *A. passiflorae*, reared from the fruit of *Passiflora vitifolia*, *A. zeteki*, from *Chrysophyllum panamense*, and *A. panamensis*, from *C. cainito*, all in the Panama Canal Zone, and *A. braziliensis*, from grapefruit in Brazil.

TUCKER (R. W. E.). **A Contribution towards the Solution of the Problem of Control of *Diatraea saccharalis* in Cane through a Mathematical Evaluation of the real Mortality of *D. saccharalis* due to Egg Parasites, Egg Predators, natural Larval Mortality, Larval Parasitism and other Factors.**—*Agric. J. Barbados* **3** no. 1 pp. 59–80, 10 refs. Barbados, January 1934. [Recd. August 1934.]

The author, following W. R. Thompson [*R.A.E.*, A **16** 484], stresses the difference between the apparent mortality caused by a control factor operating at a particular stage in an insect's life-history (which is expressed as a percentage of all individuals that have reached that stage) and the actual mortality (expressed as a percentage of the initial population). The actual mortality caused by an egg-parasite (in contrast to that caused at a later stage) is thus almost equal to the apparent

mortality. By using this principle to interpret data obtained on the mortality through various agencies of *Diatraea saccharalis*, F., in sugar-cane in Barbados [**22** 325], he calculates that (all other factors remaining equal) the 35 per cent. increase above normal in parasitism by *Trichogramma minutum*, Riley, that has sometimes been achieved by liberation produces a greater total real mortality than would a 35 per cent. larval parasitism, an amount said to be produced by *Lixophaga diatraeae*, Tns. [*cf.* **18** 167] or *Paratheresia claripalpis*, Wulp. The cumulative effect of this increase can reasonably be considered sufficient to produce an economic return far in excess of the annual cost of mass colonisation of *Trichogramma*. As, however, the combination of the control at present obtained by this means with larval parasitism would produce a satisfactory increase in total mortality, an attempt will be made during 1934 to establish both *Lixophaga* and *Paratheresia* in the Island.

During the main (or critical) period of cane growth in Barbados, early larval mortality of *Diatraea* sometimes reaches quite low average figures [*cf.* **22** 325], but it is probable that even at this period mortalities of 90 per cent. and over occasionally occur. Mathematical analysis, however, shows that their occurrence at this season must be exceptional [*cf.* **21** 543], as it would lead to the cessation of increase or serious injury by the borer. The very variable infestation that is now increasingly common in Barbados may therefore be due to occasional high larval mortality at the critical period, but it may equally well be explained by the proved occurrence of over 90 and up to 100 per cent. parasitism by *Trichogramma*. In any case, the occurrence of fluctuations in early larval mortality does not affect the value of the egg parasite, the satisfactory colonisation of which reduces them to a much smaller scale and maintains the minimum amount of damage.

In order to elucidate the general conditions under which economic control of *D. saccharalis* has been obtained and the relation between the numbers of *Trichogramma* liberated per acre during 1933 and the numbers present naturally in each month, the methods of cane-growing practised in Barbados are described. The annual increase in parasitism since mass colonisation was initiated [*cf.* **20** 98; etc.] has been accompanied by a decrease in borer damage and a rise in the yield of sugar.

Wolcott (G. N.). **Seccion de Entomologia.**—*Inf. Estac. exp. insul. Puerto Rico 1932–33*, pp. 92–103. S. Juan, P.R., 1934.

A considerable portion of this report of entomological work in Porto Rico in 1932–33 summarises information already noticed [*R.A.E.*, A **22** 137, 151–154]. *Tetrastichus haitiensis*, Gah., is a primary parasite of the sugar-cane root weevil, *Diaprepes abbreviatus*, L. [*cf.* **22** 155]. Another Eulophid, *Horismenus* sp., and possibly sometimes the Trichogrammatid, *Ufens osborni*, Dozier [**20** 353], may be secondary species attacking eggs parasitised by *Tetrastichus*. A parasite reared from the pink sugar-cane mealybug [*Trionymus sacchari*, Ckll.] proved to be an undescribed species of *Pseudaphycus*. A species of *Tiphia* occurs in Porto Rico, but is too rare [*cf.* **15** 413] to be of value against white grubs [*Lachnosterna*]. As *Tiphia* has been observed in Haiti feeding on the flowers of wild parsnip [*Peucedanum sativum*], this plant is being grown as a food-supply for the Scoliid. *Cosmopolites sordidus*, Germ., is more serious as a pest of plantain [*Musa sapientum* var. *paradisaica*], which is the preferred food-plant, than of banana. Immersion

of the corms in boiling water was found to be useless, as at least half an hour would be required to kill weevils only one inch from the surface. Other measures are recommended [*cf.* **19** 694 ; **22** 451].

Observations of maga [*Montezuma speciosissima*], an alternative food-plant of *Platyedra* (*Pectinophora*) *gossypiella*, Saund. [**20** 401], showed that the season when this tree has no pods available for infestation coincides with the resting stage of the bollworm [*cf.* **21** 647]. The destruction of the fruiting tops of maga trees by a hurricane in September 1932, combined with the eradication of wild cotton and the temporary cessation of cotton-growing for economic reasons, has apparently almost eliminated the bollworm from the northern part of the Island.

BONDAR (G.). **O podador de cacau.** [The Cacao Pruner.]—*Bahia rural* **1** no. 9 pp. 247–248, 2 figs. Bahia, May 1934.

Cacao in the Brazilian state of Bahia is attacked by a weevil, here described as *Chalcodermus marshalli*, sp. n. The adult makes a line of holes encircling a new shoot about 2–4 inches from the tip. The egg is deposited in a hole slightly nearer to the tip, and the larva feeds within the latter and after about 10 days drops to the ground, where it passes the pupal stage at a slight depth. Other plants in which the weevil breeds include *Astrapea bornea*. The adults may be jarred off and killed, and the eggs and larvae can be destroyed by collecting the infested tips.

WIGGLESWORTH (V. B.). **Insect Physiology.**—Fcap 8vo, x+134 pp., 13 figs., 297 refs. London, Methuen & Co., Ltd., 1934. Price 3*s.* 6*d.*

In this general account of the physiology of insects, based on original work and on a study of nearly 2,000 publications (of which only the more recent ones have been included in the bibliography), the author has endeavoured to meet the demand for increased knowledge on this subject on the part of the economic entomologist. Descriptions are given of the major functions of the organs and tissues and the mechanisms by which they are co-ordinated to serve the purpose of the insect as a whole, various points being illustrated by reference to particular genera or species. Separate chapters deal with the integument, respiration, the circulatory system and the blood, digestion, excretion, nutrition and metabolism, reproduction and growth, and the nervous system, sense organs and behaviour.

SMITH (K.). **The Plant Virus in the Insect Vector.**—*Arch. exp. Zellforsch.* **15** reprint 1 p. Jena, 1934.

Insect vectors of plant viruses are classified as purely mechanical, half-specific (where the virus concerned is transmissible only by a particular group of insects) and specific (where it is transmissible only by that particular species). The duration of the infective power of a vector may depend on multiplication of the virus in it [*cf. R.A.E.*, A **21** 486] or on the amount ingested. Although no correlation has yet been found between any physical property of a plant virus and its transmissibility by insects, many insect-borne viruses seem to have a high capacity for adsorption to certain substances and also have a very short life *in vitro*.

Smith (K. M.). **Insects in Relation to Virus Diseases of Plants.**—*Agric. Progr.* **11** pp. 86–88. London, 1934.

The fact that most insect vectors of plant viruses belong to the order Rhynchota [*cf. R.A.E.*, A **19** 583] is probably due to the method of feeding, the saliva that flows down one channel of the sucking beak acting as the vehicle of the virus in its passage to a new host. Examples are given of varying degrees of closeness in the association of plant viruses with insect vectors.

Owing to the wider distribution of the latter due to improved methods of transport and communication between countries, the importance of plant viruses has greatly increased during the last 10 years. Propagation by vegetative methods produces the most serious damage, as the virus is present in all parts of an affected plant except the true seed, as shown in the degeneration of English potato crops by continued propagation of virus-infected seed tubers [*cf.* **21** 488].

Smith (K. M.). **Some Aspects of the Plant Virus Problem.**—*Agric. Progr.* **11** pp. 88–92. London, 1934.

The history of plant virus diseases is briefly reviewed, and the physical properties of the viruses (reactions to physical and chemical agents, length of life in extracted sap, filtrability, etc.) are discussed. As regards size of particles, they range from tobacco mosaic (0·015 μ) to one of the potato viruses (0·25 μ). A virus is tentatively defined as an agent below or just on the border-line of microscopic visibility that causes disturbance of the functions of living cells and is itself regenerated in the process. Classification according to the type of symptom produced is complicated by the facts that the same virus may cause apparently different diseases in different species or varieties of plants and that two viruses occurring together in one plant may give rise to a single disease [*cf. R.A.E.*, A **20** 63 ; etc.]. The intracellular inclusions known as X-bodies, which are characteristic of virus diseases, are protoplasmic and are thought to be a pathological response of the cell cytoplasm to the action of the virus.

Methods of dissemination of plant viruses are briefly discussed. The elimination of the insect vector would generally prevent the spread of the disease, but the best results could only be obtained under glass, where fumigation is possible. Out of doors, the development of resistant varieties and the ruthless elimination of diseased plants are the measures recommended.

Howells (D. V.). **Strawberry Culture—II.**—*Scott. J. Agric.* **17** no. 3 pp. 287–293. Edinburgh, July 1934.

In the course of this paper on the diseases of strawberries, the biology and control of *Tarsonemus fragariae*, Zimm., are discussed with reference to the literature [*R.A.E.*, A **21** 371 ; etc.]. This mite is widely distributed in Great Britain and has been found in the Lothians and Lanarkshire, being less common and possibly less injurious in the latter district owing to the wetter and colder climate. In Scotland, oviposition begins in May and may continue until October, all stages being found on the same leaf during summer. It has not been conclusively demonstrated that the mite is entirely responsible for the whole damage associated with an attack. It has recently been suggested that it may

be connected with the spread of the virus disease, yellow-edge [but *cf.* **21** 296]. Measures recommended are hot water treatment of the runners [**22** 234] and two applications of a 3 per cent. solution of lime-sulphur or a petroleum emulsion applied with a spreader at a pressure of 250 lb. per sq. inch.

Barnes (H. F.) & Walton (C. L.). **The Asparagus Miner,** *Melanagromyza simplex* **Loew [Diptera : Agromyzidae].**—*Ent. mon. Mag.* **70** no. 843 pp. 183–185. London, August 1934.

Agromyza (*Melanagromyza*) *simplex*, Lw., has been found attacking asparagus stems in several parts of England. In a district in Worcestershire in September 1933, 1–10 puparia occurred about ground level in some 30 per cent. of the stems [*cf. R.A.E.*, A **20** 465], but there was no indication that infestation affected the health of the plants. In Herefordshire, the adults were present in the field from about 4th June until the end of the month. The first larvae were found on 28th June. The parasites reared were the Braconid, *Dacnusa bathyzona*, Marsh., the Eulophid, *Pleurotropis epigonus*, Wlk., and a Pteromalid, *Sphegigaster* sp.

Wilson (S. E.). **Changes in the Cell Contents of Wood (Xylem Parenchyma) and their Relationships to the Respiration of Wood and its Resistance to *Lyctus* Attack and to Fungal Invasion.**—*Ann. appl. Biol.* **20** no. 4 pp. 661–690, 11 figs., 10 refs. Cambridge, November 1933.

In the second part of this paper, starch is shown to be the principal food of *Lyctus* spp. in the sapwood of timber, from which it may be removed by seasoning [*R.A.E.*, A **20** 454]. In cricket-bat willow (*Salix coerulea*) in Britain, the larvae are usually found in the youngest annual ring of wood, to which the starch is confined. Occasionally, however, instead of pupating just below the surface, they may penetrate as far as ¾ inch from the starch region, but they derive no nourishment from the deeper layers. The exit holes of the adults, which tunnel from the pupal chamber by the shortest line to the outside, may therefore be found on the surface of the first annual ring and on the radial faces of the " clefts " (the triangular cross-sections into which the logs are divided by radial splits). The tunnels of these more deeply-burrowing larvae may be missed in the manufacturing and the pupae consequently left undisturbed. Sapwood that appears more than slightly discoloured (in minute spots or streaks of blue) through a magnifying lens on the application of an aqueous solution of iodine and potassium iodide should be removed from the clefts within about 6 months of possible infestation. In the case of logs that would provide clefts too small to make cricket bats without utilising the last annual ring, cleaving and the removal of the bark should be delayed for a few weeks until the starch has been depleted. As this process is comparatively quick, it is unlikely that any considerable loss in whiteness of the wood would result.

The heartwood of walnut is not attacked by *Lyctus*, though it contains considerable quantities of starch, and the susceptibility of this wood must therefore be related to the large proportion of starch-bearing sapwood that is apparently permitted in the manufacture of rifle stocks and furniture when it has been rendered similar in appearance to heartwood by steaming. It is suggested that walnut logs

should be seasoned " in the round " before import and tested for starch on their arrival at the factory. Where *Lyctus* is prevalent, it is necessary to seal the ends of the logs with paint or limewash to prevent oviposition and damage by the larvae during seasoning. The discovery of the minimum time required to render different woods immune from infestation is of commercial importance, and the compilation is suggested of a time schedule based on a ratio of starch to wood substance that is just too low to nourish the larvae.

MELLANBY (K.). **Effects of Temperature and Humidity on the Clothes Moth Larva, *Tineola biselliella* Hum. (Lepidoptera).**—*Ann. appl. Biol.* **21** no. 3 pp. 476–482, 11 refs. Cambridge, August 1934.

The method of breeding *Tineola biselliella*, Hum., for these studies and the experimental technique are described. Analysis of unstarved larvae dried at 105°C. [221°F.] showed the percentage of dry matter to be 40·7 in February 1932 and 1933, whereas in September 1932 it was 43·3. Fasting larvae exposed to temperatures of 35, 30, 22 and 10°C. [95, 86, 71·6 and 50°F.] and relative humidities of 0, 30, 60 and 90 per cent. at each temperature maintained their water balance in moderately dry or moderately moist air, but in very dry air the proportion of solid matter in their bodies rose, and in moist air it fell. A considerable amount of dry matter was lost by excretion and production of silk in addition to metabolism. Loss of dry matter was not affected by humidity. The results suggest that the rate at which water is evaporated from the larvae is proportional to the saturation deficiency of the air [*cf. R.A.E.*, A **21** 3].

HORA (A. M.). **On the Biology of the Mite, *Glycyphagus domesticus* DeGeer. (Tyroglyphidae, Acarina).**—*Ann. appl. Biol.* **21** no. 3 pp. 483–494, 2 refs. Cambridge, August 1934.

A list is given of the mites most commonly found in houses, the most important being *Glycyphagus domesticus*, DeG., which attacks green Algerian fibre (the shredded leaves of the palm, *Chamaerops humilis*, widely used in stuffing furniture), yeast, dry fodder, dried fruits, cheese and any kind of mouldy substance [*cf. R.A.E.*, A **14** 584]. Other mites attacking green or decaying Algerian fibre are *G. cadaverum*, Schr., *G. plumiger*, Koch, *Tyroglyphus dimidiatus* Herm. (*longior*, Gerv.) and *T. heterocomus*, Michael. These Tyroglyphids are kept in check to some extent by larger predacious mites, the two commonest species being *Cheyletus eruditus*, Schr., and *Cheletomorpha venustissima*, Koch. As the Cheyletids tend to eat each other as soon as the number of Tyroglyphids becomes reduced, the check is not adequate.

The fibre often becomes infested with *G. domesticus* in warehouses or the holds of ships before being used for stuffing. It is probable also that small numbers of this Tyroglyphid are always present in houses, and heavy infestations may occur in dark, damp and rarely used rooms, as it feeds on mould fungi growing on wallpaper, etc. [*cf.* **21** 619]. All stages of this species are briefly described. Observations in Britain showed that the adults pair after emergence from the deuteronymphal skin, and clusters of eggs are laid about a week later. At 25°C. [77°F.] and 90 per cent. relative humidity, the larvae hatched after 5 days and having fed for 2 days passed into a resting stage of 2 days before the protonymphs emerged. These were active for 4 days and inert for 2, and the resulting deuteronymphs had 5 days of activity and

a resting stage of 2 days, after which the adults emerged. In as many as 50 per cent. of individuals, the resting stage of the protonymph is replaced by a hypopial stage, which lasts for periods ranging from 5 days to 6 months, the deuteronymph only starting to develop when a suitable temperature and humidity have been attained. The occurrence of the hypopial form was not due to overcrowding or adverse conditions, and adults that had passed through this stage were indistinguishable from the others. The adults soon died at relative humidities below 60 per cent. ; above 70 per cent., they reproduced rapidly. The hypopi resisted exposure to 10 per cent. relative humidity for at least a week, but eggs were almost all killed by it in 48 hours. Below 23°C. [73·4°F.], fewer eggs were laid and the life-cycle lasted up to 5–6 weeks. Temperatures above 40°C. [104°F.] were lethal to all stages. Above 38°C. [100·4°F.], fewer hypopi survived under moist than under dry conditions.

The resting forms, which occur in cracks in the floor, walls and woodwork as well as in the stuffing itself, can be killed if the room is cleaned with a suitable disinfectant, actual washing being more effective than spraying. A 5 per cent. solution of carbolic acid will kill all stages, particularly if the solution is heated. The mites inside upholstered furniture can only be killed by continued and prolonged drying, by heating (which may spoil the leather and fabric) or by fumigation. Methyl salicylate proved very toxic to the hypopi at concentrations as low as 0·002 per cent. (by volume), and carbon tetrachloride at 0·03 per cent. or higher. Green Algerian fibre boiled in copper sulphate solution and subsequently treated with a wood dye akin to haematoxylin is immune from infestation, but is expensive. Undyed fibre boiled in ferrous sulphate is more resistant than that boiled in copper sulphate. Horsehair only harbours mites when it has not been properly cleaned. Coir (coconut) fibre is practically immune. Kapok occasionally harbours *T. dimidiatus*.

PARKIN (E. A.). **Observations on the Biology of the *Lyctus* Powder-post Beetles, with special Reference to Oviposition and the Egg.**— *Ann. appl. Biol.* **21** no. 3 pp. 495–518, 9 figs., 24 refs. Cambridge, August 1934.

External characters are given differentiating the sexes of *Lyctus brunneus*, Steph., and *L. linearis*, Goeze, which occur in British timbers [*cf. R.A.E.*, A **19** 72], *L. planicollis*, Lec., *L. parallelipipedus*, Melsh., and *L. cavicollis*, Lec., found in timber imported into Britain from the United States, and *L. sinensis*, Lesne, taken from imported Japanese oak [**21** 1]. The male reproductive organs of the first two and the female ones of the others (except *L. cavicollis*) are described briefly, and the eggs (except those of *L. cavicollis* and *L. parallelipipedus*) in detail. The eggs of *Lyctus* spp. in Britain usually hatch in 8–10 (but sometimes as many as 13) days, and the larvae tunnel in the wood for about 10 months and then pupate in cells just below the surface. After 3 weeks the pupal skin is discarded, and 3–4 days later the adult eats its way out through a small exit hole. After emergence, the beetles pair and oviposition follows immediately. There is one generation annually, the half or fully grown larvae hibernating. In the laboratory, beetles can be obtained all the year round, although they are scarce in winter ; in the field, the main emergence takes place in June–August, a few beetles being found during May and September under favourable weather conditions. Emergence records made

during the past 5 years at the Forest Products Research Laboratories show a ratio of 7 males to 5 females. The adult longevity varied from 3 to 6 weeks, the maximum for *L. brunneus* (68 days for a female and 54 for a male) being very much greater than that recorded for *L. linearis* [**20** 657]. One female was found still ovipositing after 40 days. The beetles are very active at temperatures above 20°C. [68°F.], but usually crawl into dark corners in daylight, taking flight only at dusk. At 30°C. [86°F.], only 1 out of 16 eggs of *L. brunneus* hatched (in 7 days).

In view of the discovery of *Lyctus* in willow [*cf.* **22** 542] and sycamore [*Acer pseudoplatanus*], the theory that small-pored woods are immune [**16** 585, 586; **17** 254] requires modification. The author found that the diameter of eggs of *L. brunneus* in large-pored wood is normally greater than that of the ovipositor (which averaged 78 μ), and that abnormally long and narrow eggs occurred in wood with small pores. If the diameter of the ovipositor is the limiting factor, only very few woods (such as horse chestnut) should be immune, though cherry and apple could only be attacked by females with ovipositors slenderer than the average.

THOMAS (I.). **On the Bionomics and Structure of some Dipterous Larvae infesting Cereals and Grasses. II.** *Opomyza germinationis* **L.**—*Ann. appl. Biol.* **21** no. 3 pp. 519–529, 5 figs., 7 refs. Cambridge, August 1934.

Studies of *Opomyza germinationis*, L., one of the commonest flies found on grasses and cereals, were carried out at Cambridge, England, in 1931 and 1932 by methods similar to those employed in respect of *O. florum*, F. [*R.A.E.*, A **22** 1]. Infested tillers of cereals and grasses were collected and planted in pots in the greenhouse, and others were caged in the open. For observations on oviposition, flies were caged in hurricane lamp glasses with muslin tops, placed over seedling cereals and grasses. In the laboratory, the larvae fed on oats, barley, wheat, *Lolium perenne*, *L. italicum*, *Dactylis glomerata*, *Festuca rubra*, *Poa trivialis* and *Cynosurus cristatus*. In the field, only a few larvae were found on the cereals, the chief food-plants being the grasses. The injury to grasses is similar to that caused by *Oscinella frit*, L., the central shoot being severed near the base. Larvae of the first instar were found in the field during October and early November, those of the second from the end of October till the beginning of February and those of the third from the end of November till mid-June. Pupation takes place in the food-plant near the ground, and adults emerge in mid-June and live until early November. In the laboratory, eggs were laid in September and October either on the plants (generally near ground level) or on the soil near the seedlings. The incubation period lasted 12–18 days, the larval instars 8–20 and 17–30 days and 8–14 weeks, respectively, and the pupal period 19–30 days. Injury was most serious on *Poa*, the larvae migrating from one seedling to another as early as the second instar. Cereals suffered less than grasses owing to their rapid growth. The immature stages are described.

HERFORD (G. V. B.). **The Pineapple Bud Moths in Hawaii.**—*Ann. appl. Biol.* **21** no. 3 pp. 530–541, 27 refs. Cambridge, August 1934.

Only three of the five species of bud-moths hitherto recorded from pineapple in Hawaii were obtained in the course of work

in the island of Oahu, and of these only *Ereunetis flavistriata*, Wlsm., and *Pyroderces* (*Batrachedra*) *rileyi*, Wlsm., were at all common. Both species, all stages of which are described, are evenly distributed over the Island, *E. flavistriata* being the commoner. The egg, larval and pupal stages of this species lasted about 2 weeks, 6 weeks or more and 11–12 days, respectively, and those of *P. rileyi* 3 days, an undetermined period and 12–13 days. Attempts to rear the larvae in captivity failed. The eggs of both species are laid on or near the young fruits, and the larvae pupate on the plants. They are most numerous in old ratoon fields, where they feed on dead plant tissue, but they appear to do very little damage to young fruits, though they are often found on them. Although bud-moths are often associated with pineapple wilt, which produces conditions favourable to the larvae, there is no evidence at all that they cause this condition of the plants. There is also no evidence that they attack healthy leaf tissue. In view of the weak flight of the adults of both species, wind is probably the principal factor in their spread. Although larvae occur frequently in slips growing below infested fruit, they are rarely discovered in a field of young plants, having probably been carried off by the ants, *Pheidole megacephala*, F., and *Solenopsis geminata*, F., which may be observed in numbers in and round curing material. Except when disturbed, the larvae are not molested by ants, but when unfavourable circumstances cause them to wander, large numbers may be killed by *P. megacephala*. Experiments and field observations fail to confirm reports that bud-moth larvae are predacious on mealybugs [*cf. R.A.E.*, A **11** 173; **15** 661], although they are often found with them.

The only parasites reared from several hundred larvae were two individuals of *Idechthis* sp. Records of parasites previously reared from these species are quoted [**18** 257, etc.]. Predators, principally Sphecoid wasps, carry off many larvae, but are relatively ineffective as a means of control. Apart from the regular spraying for the control of mealybugs [*Pseudococcus brevipes*, Ckll.] and the knocking down of old ratoon fields, which results in the almost complete annihilation of all stages except possibly the adults, no control measures are practised against bud-moths, and in view of the small amount of actual damage they do, any measures directed specifically against them would probably be waste of effort.

HERFORD (G. V. B.). **An Automatic Humidity Control.**—*Ann. appl. Biol.* **21** no. 3 pp. 542–545, 3 figs. Cambridge, August 1934.

The apparatus described consists of a powerful electric fan, which also drives a small centrifugal pump. A jet of water from this pump rotates a horizontal cylinder of perforated zinc (18 ins. long by 10 ins. in diameter), which dips into a deep tray of water. Suitable baffles are fitted to this cylinder, and air is blown over the wet metal by the fan. The arrangement of the baffles ensures thorough saturation of the air. The automatic control works on the principle of a recording hair hygrometer, regulated by an electrical circuit. At a constant temperature, the relative humidity in an insectary of 600 cu. ft. capacity having 3 outside walls only one brick thick was maintained at 73–77 per cent. With normally fluctuating summer temperatures, however, it varied from 73 to 80 per cent.

Insect Pests and their Control.—*Agric. Gaz. N.S.W.* **45** pt. 6 pp. 344–348, 7 figs. Sydney, 1st June 1934.

In continuation of this series [*cf. R.A.E.*, A **22** 476], notes are given on the bionomics and control in New South Wales of *Aspidiotus perniciosus*, Comst., *Bryobia praetiosa*, Koch, *Myzus persicae*, Sulz., and *Anuraphis persicae-niger*, Smith, on fruit trees [*cf.* **21** 480; **22** 42], and of *Bruchus* sp. in stored beans. *Agromyza phaseoli*, Coq., on beans [*cf.* **13** 522] may be controlled by regulating planting and the destruction of all crops after picking. It was advocated that no beans should be sown between 10th November 1933 and 15th March 1934.

Pescott (R. T. M.). **The Pea Mite and the Red Legged Earth Mite.**—*J. Dep. Agric. Vict.* **32** pt. 6 pp. 295–297, 2 figs. Melbourne, June 1934.

Much of this information on the bionomics and control of *Penthaleus bicolor*, Froggat (pea or blue oat mite) and *Halotydeus destructor*, Tucker (red-legged earth mite) in Australia has already been noticed [*R.A.E.*, A **18** 139; **22** 265; etc.]. These mites remove the sap and cause discoloration of the leaves of many vegetable and field crops, including wheat [*cf.* **11** 571] and barley. Young plants are often severely damaged and may die, but those that are making strong growth appear to be less affected. Where practicable, the ground should be left fallow every 3–4 years, which is the time required for a severe infestation to develop. Grasses and clovers should be turned over and buried before they have died off (to prevent the deposition of the summer eggs) and the ground worked down to a fine tilth, any subsequent growth on the fallow being suppressed. Alternatively, the mites may be allowed to hatch in autumn and may then be turned in before sowing. On land kept fallow throughout early spring and summer, infestation can only arise from untilled strips, the vegetation on which can be burned in spring as soon as it will carry a fire.

The mites may be prevented from invading a valuable crop for 4–6 weeks by surrounding it with a strip (about 3 ins. wide) of creosote [*cf.* **20** 246]. Recommendations for the destruction of mites already in the fields include dusts of tobacco and lime (1 : 1), alone or combined with a little kerosene, and a spray of 2 gals. kerosene and ½ oz. naphthalene added to ½ lb. soap boiled in 1 gal. water, this stock emulsion being then diluted with 8–10 parts water.

Leefmans (S.). **Ziekten en plagen der cultuurgewassen in Nederlandsch Oost-Indië in 1931.** [Diseases and Pests of cultivated Plants in the Netherlands Indies in 1931.]—*Meded. Inst. PlZiekt.* no. 82, 92 pp. [Buitenzorg] 1934.

Pests recorded from the Netherlands Indies in 1931, many of which have been noticed from previous reports [*R.A.E.*, A **21** 208; etc.], include *Artona* (*Brachartona*) *catoxantha*, Hmps., which attacked thousands of coconut palms in some districts; *Anoplolepis* (*Plagiolepis*) *longipes*, Jerd., on cacao; *Aulacaspis pentagona*, Targ., and *Saissetia coffeae*, Wlk. (*hemisphaerica*, Targ.) on cinchona; *Ischnaspis longirostris*, Sign., and *Valanga nigricornis*, Burm., on coffee, the latter sometimes causing complete defoliation; a Membracid, *Tricentrus* sp., fostered by *Oecophylla*, infesting blossoms of tea and reducing the setting of seed; and *Silvanus surinamensis*, L., *Tribolium* spp., and *Araecerus fasciculatus*, DeG., in stored nutmegs.

YAGI (N.). **Isodevelopmental Zonation of** *Chilo simplex* **Butler in Nippon.** [*In Japanese.*]—*J. agric. Exp. Sta. Tokyo* **2** no. 3 pp. 381–394, 2 graphs, 4 maps. Tokyo, March 1934. (With a Summary in English.) [Recd. August 1934.]

By correlating records of the mean monthly temperatures in every district of Japan with the accumulated effective temperatures required for the development of the various stages of the rice-borer, *Chilo simplex*, Butl. [*cf. R.A.E.*, A **20** 330], the author calculates that in southern Kyushu the moths of the overwintered brood and of the first and second summer broods emerge in early April, late July and mid-September, respectively. The latest dates for the first emergence of the three broods (in the northernmost districts in which each occurs) are, respectively, early August (northern Hokkaido), late September (northern Honshu) and late October (south-eastern Honshu). North of 36°N. Lat., emergence begins earlier on the west coast than on the east. It is also computed that there are 2 generations annually in Korea, 4 in the Loochoo Islands and 5–6 in Formosa.

LIU (Chi-ying). **Experiments on the Location and Submergence of the Eggs of** *Scotinophara lurida* **(Burm.).** [*In Chinese.*]—*Ent. & Phytopath.* **1** no. 1 pp. 12–16. Hangchow, 1st January 1933. (Abstr. in *Lingnan Sci. J.* **13** no. 3 p. 561. Canton, 30th July 1934.)

Observations in China have shown that 75 per cent. of the eggs of *Scotinophara lurida*, Burm., are found below a point 4 ins. from the ground on the sheaths or stems of rice, *Panicum crus-galli* or *Marsilia quadrifoliata*. This Pentatomid can therefore be destroyed by submerging the eggs [*cf. R.A.E.*, A **19** 24]. This should be effected by flooding the field to a depth of 4–5 ins. every fourth day between 1st and 20th July and allowing the water to stand for about one day.

JUNG (Goey-park). **Two important home-made Insecticides.** [*In Chinese.*]—*Ent. & Phytopath.* **1** no. 10 pp. 222–224. Hangchow, 1st April 1933. (Abstr. in *Lingnan Sci. J.* **13** no. 3 p. 557. Canton, 30th July 1934.)

This paper describes the preparation and use of insecticides made from the seeds of *Croton tiglium* and the roots of (?) *Celastrus* sp. in China.

TSIANG (Nai-pin). **A preliminary Observation on the Life-history of the Mulberry Pyralid** (*Margaronia pyloalis* **Wlkr.).** [*In Chinese.*] —*Ent. & Phytopath.* **1** no. 15 pp. 333–337. Hangchow, 21st May 1933. (Abstr. in *Lingnan Sci. J.* **13** no. 3 p. 572. Canton, 30th July 1934.)

All stages of the Pyralid, *Margaronia pyloalis*, Wlk., a pest of mulberry in China [*cf. R.A.E.*, A **14** 200], are briefly described. The incubation period is 5–6 days. There are 5 instars, the duration of which differs slightly in the 5 generations that occur in a year. The pupal stage averages more than a week. The adult is very active at night. The number of eggs laid varies from 36 to 89.

Chen (Kan-fan) & Sung (Tsu-lien). **Observations on the Life-history of the Mulberry Looper** (*Hemerophila atrilineata* **Butl.) at Hangchow and Kashing.—A Summary.** [*In Chinese.*]—*Ent. & Phytopath.* **1** nos. 17–18 pp. 368–372, 392–396. Hangchow, 11th & 21st June 1933. (Abstr. in *Lingnan Sci. J.* **13** no. 3 p. 542. Canton, 30th July 1934.)

The only food-plant of *Hemerophila atrilineata*, Butl., is mulberry. All stages are briefly described. In Chekiang, the incubation period varies from 3 to 11 days. There are normally 4 instars, but larvae that hibernate have 5. Pairing takes place 1 day after emergence. One female lays from 388 to 1,130 eggs. There are 4 generations a year. The adults are active at night and live for about a week. Natural enemies include two Hymenopterous parasites and a Dipteron.

Chu (Joo-tso). **On the Mulberry Coccid,** *Drosicha contrahens* **Walker.** [*In Chinese.*]—*Ent. & Phytopath.* **1** no. 19–20, pp. 410–414. Hangchow, 11th June 1933. (Abstr. in *Lingnan Sci. J.* **13** no. 3 p. 547. Canton, 30th July 1934.)

The most important food-plants of the Coccid, *Drosicha contrahens*, Wlk., in Chekiang are mulberry, *Sapium sebiferum*, elm, *Citrus*, and *Ligustrum lucidum*. Larvae hatch at the end of January, maturing in the middle of May after 3 months. The male first moults in the beginning of April ; the prepupal period is at the end of April, pupation occurs at the beginning of May, and the adult emerges in the middle of May. Pairing takes place within a week of emergence. By the middle of June, a female can lay 262 eggs. The Coccinellid, *Rodolia* (*Novius*) *limbata*, Motsch. [*cf. R.A.E.*, A **18** 320] is the chief natural enemy. Control measures include destruction of the eggs by turning over the earth or breaking it near the roots, banding with an adhesive and brushing off the larvae by hand.

Chen (Kan-fan). **An Investigation on Cerambycids attacking Mulberry in Kashing.** [*In Chinese.*]—*Ent. & Phytopath.* **1** no. 25 pp. 532–534. Hangchow, 1st September 1933. (Abstr. in *Lingnan Sci. J.* **13** no. 3 p. 542. Canton, 30th July 1934.)

The species recorded as injurious to mulberry in Kashing (Chekiang) are the Cerambycids, *Xylotrechus chinensis*, Chevr., *Anaesthetobrium luteipenne*, Pic, and *Mallambyx raddei*, Blessig, and the Lamiids *Psacothea hilaris*, Pasc., *Pterolophia annulicornis*, Pic, *Olenecamptus clarus*, Pasc., *O. subobliteratus*, Pic, *Melanauster chinensis*, Forster, *Apriona rugicollis*, Chevr., *Paraglenea fortunei*, Saund., *Oberea fuscipennis*, Chevr., *Batocera lineolata*, Chevr., var. *latealba*, Pic, and *Ropica subnotata*, Pic.

Chu (Joo-tso). **Notes on the Parasitism of** *Dendrolimus punctata* **Wlk. and** *Clania minuscula* **Butl.** [*In Chinese.*]—*Ent. & Phytopath.* **1** no. 29 pp. 625–627. Hangchow, 11th October 1933. (Abstr. in *Lingnan Sci. J.* **13** no. 3 p. 547. Canton, 30th July 1934.)

The larvae of *Dendrolimus punctatus*, Wlk., are parasitised in Chekiang by *Mesostenus* sp., and the pupae by *Xanthopimpla japonica*, Krieg., and *Brachymeria euploeae*, Westw. *Pimpla* (*Epiurus*) *nankingensis*, Uchida, *P.* (*Exeristes*) *albicincta*, Morl., and a Dipteron are parasites of *Clania minuscula*, Butl.

Lieu (K. O. Victoria). **A preliminary Note on the Survey of a Mulberry Borer under Observation.** [*In Chinese.*]—*Ent. & Phytopath.* **2** no. 6–7 pp. 102–104, 2 figs. Hangchow, 1st March 1934. (Abstr. in *Lingnan Sci. J.* **13** no. 3 p. 559. Canton, 30th July 1934.)

The larva is described of a Lepidopterous borer of mulberry in Chekiang, the adult not having been available for study. The damage it causes is quite serious, though not so conspicuous as that of *Rondotia menciana*, Moore [*cf. R.A.E.*, A **22** 125].

Chen (Fong-ge). **Notes on two Coccinellids of Hwang-yeh, Chekiang.** [*In Chinese.*]—*Ent. & Phytopath.* **2** no. 8 pp. 142–148, 1 pl. Hangchow, 11th March 1934. (Abstr. in *Lingnan Sci. J.* **13** no. 3 p. 541. Canton, 30th July 1934.)

Two species of the Coccinellid genus *Rodolia*, one of which is *R. rufopilosa*, Muls., feed extensively on *Icerya purchasi*, Mask., in *Citrus* orchards in Chekiang, destroying over 90 per cent. The unidentified species was introduced into China in 1932 from Formosa against this scale, and owing to its rapid development and late hibernation, it is recommended for control in this locality. Notes are given on the distribution, external morphology (of all stages) and habits of both species.

Hsu (Kao-tung). **Notes on the Trip to I-wu.** [*In Chinese.*]—*Ent. & Phytopath.* **2** no. 11 pp. 200–206. Hangchow, 11th April 1934. (Abstr. in *Lingnan Sci. J.* **13** no. 3 p. 555. Canton, 30th July 1934.)

The insect pests observed in the I-wu district (Chekiang) include the following, all of which are injurious to pear :—the Cephid, *Janus piri*, Okam. & Muram., damaging the trunks and branches, the Melolonthids, *Serica* sp., and *Lachnosterna* (*Holotrichia*) sp., Longicorns and Limacodids. Other common pests are *Cirphis* (*Leucania*) *unipuncta*, Haw., Geometrids on beans, *Dendrolimus* sp., and *Nygmia* (*Euproctis*) *bipunctapex*, Hmps.

Cheng (Kao-tsiang). **Observations on the Morphology and Hibernation of the Rice Fulgorid, *Nisia atrovenosa* Leth.** [*In Chinese.*]—*Ent. & Phytopath.* **2** no. 12 pp. 218–219. Hangchow, 21st April 1934. (Abstr. in *Lingnan Sci. J.* **13** no. 3 p. 544. Canton, 30th July 1934.)

A brief description is given of the Meenoplid, *Nisia atrovenosa*, Leth., which is injurious to rice in Chekiang, the larvae and adults attacking the lowland crops. Eggs are laid in masses on the surface of the leaves or stems of rice or wild grasses. There are 4 generations a year. A table is given showing the percentages of eggs laid in different places. Destruction of the overwintering egg-masses, burning wild grasses and rice stubble, ploughing in winter and flooding are the remedial measures recommended.

Hsu (Kao-tung). **Notes on a Trip to Yenchow.** [*In Chinese.*]—*Ent. & Phytopath.* **2** no. 15 pp. 276–283, 2 figs. Hangchow, 21st May 1934. (Abstr. in *Lingnan Sci. J.* **13** no. 3 p. 555. Canton, 30th July 1934.)

This paper deals with Geometrids that feed on the leaves of tung oil trees [*Aleurites*] and the Halticid, *Podontia lutea*, Ol., feeding on the

leaves of varnish trees [? *Rhus vernicifera*] in Yenchow (Chekiang). Descriptions are given of all stages, with notes on their distribution, habits and control.

Hoffmann (W. E.). **The Life History and Economic Status of** *Sycanus croceovittatus* **Dohrn (Hemiptera, Reduviidae).**—*Lingnan Sci. J.* **13** no. 3 pp. 505–515, 2 pls., 7 refs. Canton, 30th July 1934.

During 1933 and 1934, *Sycanus croceovittatus*, Dohrn, was found in great numbers in Canton destroying noxious sawfly larvae on bamboos, besides various caterpillars, including *Pieris rapae*, L. A detailed account is given of the distribution, morphology (of all stages) and bionomics of this Reduviid. Egg-masses have not been observed in the field, but in the laboratory they were deposited at short intervals during May, the greatest number laid by one female being 3. One individual may lay at least 200 eggs. Eggs laid on 9th May hatched in 22 days, and others laid on the 12th in 15 days. There are 5 moults. The feeding habits are described, those of the nymphs and adults being essentially the same. Gravid females are voracious. Reddish Aphids found on the Chinese tallow tree (*Sapium sebiferum*), a sawfly on pear, Syrphid and Coccinellid larvae, and the caterpillars of *Papilio demoleus*, L., are not attacked. Nymphs hatching on 30th May completed development in 51–56 days. There appear to be at least two complete generations a year. Adults that had overwintered as nymphs paired on the 10th day after the final moult, and the females oviposited on the 19th. The pre-oviposition period of females reaching maturity during the middle of summer is probably less. Hibernating nymphs are found beneath stones and other objects in grassy plots. During late spring and summer, the nymphs and adults are usually found on low-growing vegetation, but adults have been found on bamboo at a height of 7 or 8 feet.

Bodenheimer (F. S.) & Tenenbaum (B.). *Icerya purchasi* **Mask. and its Control in Palestine.**—*Hadar* **6** no. 2 pp. 32–34, 2 figs. Tel-Aviv, February 1933. [Recd. August 1934.]

The information given on the bionomics of *Icerya purchasi*, Mask., on *Citrus* and *Spartium junceum* in Palestine and its control by *Rodolia (Novius) cardinalis*, Muls., is similar to that already noticed from a fuller account [*R.A.E.*, A **21** 176]. This Coccid never becomes sufficiently numerous in Palestine to encrust the twigs, but the honeydew it secretes promotes the growth of a sooty mould, which reduces the market value of the fruit, often causing considerable losses. Bushes of *S. junceum* planted in orange groves where *Icerya* is a constant trouble might provide a permanent centre for *Rodolia*, from which it could readily spread to the neighbouring *Citrus* trees.

Rivnay (E.). **Notes on the Thysanoptera found on** *Citrus* **in Palestine.**—*Hadar* **6** no. 11 pp. 255–257, 3 figs. Tel-Aviv, November 1933. [Recd. August 1934.]

Brief notes are given on about 17 species of thrips collected during 2 years from *Citrus* and other plants within and surrounding the groves, to determine what species are injurious to *Citrus* fruit, their relative economic importance and their relation to alternative foodplants. The following is based on the author's discussion: *Haplothrips* spp., *Kakothrips pisivorus*, Westw. (*robustus*, Uzel), *Phloeothrips*

(*Hoplandrothrips*) sp., *Aeolothrips deserticola*, Pries., and *Limothrips cercalium*, Hal., were all very scarce on *Citrus*. *Franklinothrips myrmicaeformis*, Zanon, which was found on the leaves of *Citrus* during June–July 1931 but was absent the following summer, *Karnyothrips longisetis*, Bagn., which was numerous between the sepals and the fruit and is common on the coastal plains between December and February, and *Haplothrips andresi*, Pries., the larvae and adults of which were found on the fruit, particularly during May, are all predacious, but are of little value owing to their rarity. *Heliothrips haemorrhoidalis*, Bch., is distributed throughout the coastal plain and may render useless as much as 25 per cent. of the fruit, being particularly injurious in old, shaded groves. In the absence of fruit it attacks *Citrus* leaves, and it has also been found in Palestine on tobacco, avocado and various Compositae. The food-plants of *Thrips tabaci*, Lind., in Palestine include *Citrus*, grapes and cabbages; particularly severe damage is caused to the young fruits, which are attacked at the point of attachment to the stalk (when they are the size of a small walnut) and turn yellow and fall prematurely. The following polyphagous species are found in the flowers of *Citrus* and injure the fruit: *Taeniothrips discolor*, Karny, which is abundant in the coastal plain and the hills bordering it from early November to April; *T. meridionalis*, Pries., which is found in abundance throughout the country during April; *Odontothrips karnyi rivnayi*, Pries., which is very common during November–April; and *Thrips major*, Uzel (*banaticus*, Knechtel), which is numerous in one locality during December–April. The two last-named occur also in the flowers of loquat.

Infestation of *Citrus* has become greater in the last few years owing to the reclamation of previously uncultivated lands and the migration to the groves of some of the polyphagous thrips from the weeds on which they were numerous. In years in which late rains delay plant growth, the thrips infest *C. medica*, which blooms early in the winter, and consequently cause injury to the fruit. An early dry summer or a poor rainy season, which withers vegetation prematurely, leads to the migration of large numbers of thrips to the cultivated plants kept fresh by artificial irrigation.

Bodenheimer (F. S.) & Klein (H. Z.). **On some Moths injurious to *Citrus* Trees in Palestine.**—*Hadar* **7** pp. 8–10, 6 figs., 2 refs. Tel-Aviv, 1934.

The larvae of *Prays citri*, Mill., have been known to feed on the flowers of *Citrus medica* in Palestine during January–March, covering them with silken threads, but they are of little economic importance, as this tree is not widely cultivated and only a few of the flowers ever produce fruit. It has been observed recently, however, that in young *Citrus* plantations throughout the coastal plain the larvae of this moth may enter the grafting union through the rafia dressing shortly after grafting in the beginning of November and bore into the cambium. This damage, which may be considerable, results in the failure of the grafting, which can only be repeated the following year. The injury is not noticeable until the removal of the rafia, when the bud appears discoloured and wrinkled. The appearance of the stages and the type of damage caused in the Philippines are described from the literature [*R.A.E.*, A **12** 270].

The larvae of *Ephestia vapidella*, Mann, have recently damaged the stubs of *Citrus* root-stocks 1–2 years old during summer and destroyed young trees in the first year following grafting. A brief description is given of the stages, with the exception of the egg, which is unknown. There were 2–3 generations from late summer until spring. Larvae were most injurious in August, pupating in the second half of the month. The adults emerged in early September. Larvae, possibly of the next generation, were present from about the end of September to early in October, pupating towards the end of October, and others during January, pupating late in March. The moths emerged early in November and early in April. There are probably 3–5 generations on the coastal plain, development occurring on *Citrus* during summer and winter and on carob (*Ceratonia siliqua*) in autumn. Excrement and small drops of gum are noticeable below infested bark of *Citrus* from August. The larvae have been found feeding in the stub near the grafting union, eating half the basis or gnawing round the scion, which frequently breaks, or on twigs that have not been cut sufficiently near the base and that show callus formation, or on suckers growing from root-stocks of sweet lime [*C. medica* var. *limetta*] after unsuccessful grafting. No damage has been observed on trees that were planted after grafting and treated properly with the branches cut at the bases and the stubs removed. These stubs, which often project about an inch, dry quickly and are always the first point to be infested. Injury by *E. vapidella* necessitated the cutting out and replacing of about 400 orange trees in one grove. During January, a larva was found feeding in a twig of *Citrus*, which subsequently died. To prevent infestation, the projecting stubs should be cut not later than early June and the branches cut at their base and the exposed surface covered with asphalt. Plaster is ineffective and was found to attract the larvae to branches.

A covering of asphalt, which may be applied to limes after the injured part has been removed, also prevents the entry of *Cryptoblabes gnidiella*, Mill. This Tineid also fed on the stubs of oranges grafted on sweet limes in June and early July, causing similar damage to that due to *E. vapidella*. Larvae of an unidentified moth have done considerable harm in some groves by feeding in galleries in the union of freshly grafted in-arches of sour oranges on diseased sweet lime. The in-arches dry up. No protection was afforded by covering the grafting union with plaster, rafia or sometimes even with asphalt.

BODENHEIMER (F. S.). **Contributions towards the Knowledge of the Red Scale** (*Chrysomphalus aurantii* **Mask.) in Palestine.**—*Hadar* **7** no. 6 pp. 139–148, 4 figs., 7 refs. Tel-Aviv, June 1934.

A list is given of the food-plants of *Aonidiella* (*Chrysomphalus*) *aurantii*, Mask., in Palestine, where it is fairly common on roses and willows and a serious pest of *Citrus*, reducing the quality of the fruit and rendering it unfit for export, besides causing the appearance of yellow spots on the leaves and poisoning heavily encrusted branches.

The body temperature of this Coccid in its preferred environment (the shady interior of *Citrus* trees) averaged 6·3°C. [11·24°F.] higher than that of the environment. In full shade, the larval and pre-oviposition periods of the females ranged from 17 to 42 and 29 to 204

days and the development of the males from 23 to 86 days, the thresholds of development being 14 and 7·5°C. [57·2 and 45·5°F.], respectively, and the thermal constants 688 and 578 day-degrees C. [1238·4 and 1040·4 F.]. By comparing these data with others obtained in California in a sunlit greenhouse [*R.A.E.*, A **20** 138], an estimate is made of the number of generations occurring annually in shade and partial sun in various parts of the world. The high solar radiation and relatively low humidity prevailing at Jerusalem are unfavourable. In the coastal plain, 3 overlapping generations may develop in the shaded parts of the trees and 4–5 in the sunny ones, the larvae being particularly abundant in August and during September–October (the periods of chief economic importance) and during February–March and in May. As a rule, they remain under the parent scale for ½–2 days after hatching. They then usually settle within the first day not more than 1½ ft. away, most often on the surface of the leaf or fruit exposed to the light, though the warming rays of the sun may be the influencing factor. In the Jordan Valley, the centre of the crown of the tree is more highly populated than in the coastal plain, where the average summer shade temperature reaches or exceeds the optimum of 29·7°C. [85·26°F.]. Death occurs instantaneously at 43°C. [109·4°F.], which explains the mortality among the young larvae during the dry desert winds, which often raise the temperature above this limit. The larvae are able to migrate to the shoots of the particular tree on which they are situated and may infest those of a neighbouring one, at any rate in the older, closely planted orange groves, where the growth interlaces. The principal means of spread is the wind.

Parthenogenesis was not observed. The adult females, which are usually more numerous than the males, live from 28 to 250 days or more. Observations in the laboratory and the field showed that 44 females laid an average of about 62 eggs each on the leaves, of which 41 hatched, and that 51 laid 104 each on the fruit, of which 80 hatched. In experiments on oranges, slightly over 60 larvae per female settled. The greatest number of eggs is laid on the leaves during March–July and apparently on the green branches during April–June. Mature females are absent from the fruit during April–July and from the green branches during the hot season (July–September). The optimum conditions for oviposition are a temperature of 18–20°C. [64·4–68°F.] and 70–74 per cent. relative humidity ; outside a range of 15–27°C. [59–80·6°F.] and 68–80 per cent. relative humidity, less than 17 eggs are laid.

During 1931–33, the average number of scales per 100 leaves in one grove fluctuated from 0·2 (in May) to 34 (in November). The greatest number usually die in May and September with the occurrence of the dry desert winds. Little mortality usually occurs after the crawling stage. The numbers are reduced by rain and by the dropping of the leaves in spring and the picking of the fruit in winter. Natural enemies are of no great importance, the most valuable being *Aphytis* (*Aphelinus*) sp., which is common in late autumn and early winter, when the scales are most numerous, and *Chilocorus bipustulatus*, L., which is mainly active in autumn and winter. Others of less importance include *Conwentzia psociformis*, Curt., and *Pediculoides ventricosus*, Newp. It appears probable that the vitality of *A. aurantii* (as shown by resistance to standardised oil sprays) varies annually, and it is possible that its vitality is correlated with its average abundance in the respective years.

Bodenheimer (F. S.). **Spraying versus Fumigation in Red Scale Control.**—*Hadar* **6** no. 12 pp. 285–286. Tel-Aviv, December 1933. [Recd. August 1934.]

The relative merits of tent fumigation with hydrocyanic acid gas, recently introduced into Palestine, and spraying with white oils, which has been undertaken during about the last two years, in the control of *Aonidiella* (*Chrysomphalus*) *aurantii*, Mask., on *Citrus* are discussed. Although no definite statement is possible until experience has been gained over about two years on the cost of either treatment, it is probable that eventually both will be employed, as in other countries.

Baranoff (N.). **Mitteilungen über gezüchtete orientalische Larvaevoriden (Insecta, Diptera).** [Communications on reared Oriental Tachinids, etc.]—*Ent. NachrBl.* **8** no. 2 pp. 41–49. Troppau, July 1934.

The 28 parasitic Tachinids recorded include the following new species: *Sturmia hutsoni* from *Earias fabia*, Stoll, in Ceylon; *S. nigribarbis* from *Hapalia machaeralis*, Wlk., in Burma; *S. painei* from *Tirathaba* sp. in Java; *Exorista quadrimaculata* from Psychids in Malaya, Sumatra and Ceylon; *Erycia bezzii* from *Telicota palmarum*, Moore, in Malaya; *Bactromyia fransseni* from *Cnaphalocrocis medinalis*, Gn., in Java, and *Lamprosema diemenalis*, Gn., *Psara bipunctalis*, F., and *Nacoleia annubilata*, Swinh., in Ceylon; *Tricholyga psychidarum* from Psychids in Malaya and Sumatra; and *Stomatomyia bezziana* from *Nephantis serinopa*, Meyr., in Ceylon.

Cuthbertson (A.). **Biological Notes on some Diptera in Southern Rhodesia.**—*Proc. Rhod. sci. Ass.* **33** pp. 32–50. Salisbury, S. Rhod., May 1934.

The species dealt with include *Stomatorhina lunata*, F. [*R.A.E.*, A **21** 673], of which the larvae were present in Southern Rhodesia at the time of oviposition of the red locust [*Nomadacris septemfasciata*, Serv.] during November–December 1933. In the laboratory, the larvae hatched within a few minutes from eggs laid in soft soil above the locust egg-pods and made their way down to these, which they attacked immediately. They left the egg-pod after 3–4 days and pupated after a prepupal period of 1–2 days. Emergence occurred in 7–10 days, but occasionally in cold, dull weather the adults did not appear for 14–15 days or more. Pairing occurred within 4–5 days and oviposition began about 6–7 days after emergence from the puparia. *Diploneura armipes*, Brues, and another Phorid have been reared from egg-pods of this locust in breeding cages.

The Tachinids recorded from Lepidopterous hosts include the following: *Dejeania bombylans*, F., a common and widely distributed species that was abundant in Salisbury during September and March–April, from the American bollworm [*Heliothis obsoleta*, F.]; *Exorista fallax*, Mg., *Zenillia pilipes*, Villen., *Gonia munroi*, Curran, and *G. bimaculata*, Wied., all of which are widely distributed, the last being common from December to May, *G. capitata*, DeG., which is common during November–February, and *Wagneria nigrans*, Mg., which undergoes a pupal period of 11 days in October, all from *E*[*uxoa*] *segetum*, Schiff.; *Linnaemyia angulicornis*, Speiser, which was abundant on the

flowering heads of grasses in April 1931, from *Cirphis loreyi*, Dup., on maize cobs in July 1913 ; *Nemoraea capensis*, R.-D., from *Diparopsis castanea*, Hmps., during January–February 1930 ; *Sturmia atropivora*, R.-D., which is widely distributed in East and South Africa and is abundant in one district during February–April, and *S. dilabida*, Villen., which is widely distributed in South Africa, both from *Herse convolvuli*, L., on sweet potato in March and the latter also from *Laphygma exigua*, Hb., in April 1914 ; *S. inconspicua*, Mg., from *L. exempta*, Wlk., on onions in July 1932 ; and *Z. evolans*, Wied., which is common during January–April, from the overwintering brood of *Busseola fusca*, Full., in November–December. *Z. sordida*, Villen., was recorded from *Athalia flacca*, Konow (turnip sawfly) in June 1913.

Haines (G. C.). **Control of the Lawn Caterpillar.**—*Fmg in S. Afr.* reprint no. 43, 1 p. [Pretoria] June 1934.

The larvae of *Spodoptera abyssinia*, Gn., a pest of lawns in various parts of South Africa, hatch from eggs laid on the stems of grass and feed at night on the tender shoots, causing brown patches to appear. Re-infestation may occur from a second generation. This Noctuid can be readily controlled by a bait of 4 oz. Paris green (or white arsenic or lead arsenate, which are less toxic), 1 lb. sugar and 5 lb. bran mixed into a crumbly mash with water and applied thinly late in the afternoon. The lawn should be brushed with a broom if the bait has been spread unevenly, and watered about noon the following day if the poison presents any danger. A spray of 2 oz. lead arsenate powder in 4 gals. water may also be applied late in the afternoon ; a fall of rain shortly after either treatment will necessitate a second application. Outbreaks may be checked by flooding the lawn and collecting the larvae, which is slow but effective, or by vigorous sweeping at night when they are feeding.

Haines (G. C.). **Control of Mylabris or Blister Beetles.**—*Fmg in S. Afr.* reprint no. 44, 1 p. [Pretoria] June 1934.

Meloids are fairly widespread in South Africa. In the immature stages, they apparently live within the egg-pods of locusts and allied insects. The adults feed by preference on the petals of beans and peas, though they may attack fruit blossoms and sometimes eat the leaves ; the actual amount of damage they do is uncertain, but if they are excessively numerous thay may affect the setting of the fruit. Serious damage may be caused in flower gardens. Sprays have not proved satisfactory, as they do not adhere easily to the blossoms and large quantities are necessary to kill the considerable numbers often present. Hand-collecting (especially with a tin containing water and kerosene) is an effective and practical method for use in small gardens, having reduced heavy infestations to practically negligible proportions after 5 days. If properly carried out, it should also be effective on larger crops in fields and orchards.

Ripley (L. B.) & Hepburn (G. A.). **Adhesives for Cryolite Suspensions.**—*Sci. Bull. Dep. Agric. S. Afr.* no. 122, 12 pp., 3 charts. Pretoria, 1934. Price 3*d*.

With a view to developing an insecticide for application to the tops of maize against *Busseola fusca*, Full., in South Africa that would remain

effective for a week or more, it was thought desirable to incorporate in the derrisol [*R.A.E.*, A **19** 56 ; **22** 79] a stomach poison that would adhere to the foliage. Cryolite was chosen because of its high toxicity to the stalk-borer relative to scorching and cost, and a thorough search was made for an adhesive that would not lower its suspensibility to a marked degree. For determining relative adhesiveness, glass plates on which a water suspension of cryolite plus adhesive had dried to a thin and uniform film were weighed, subjected to a standard artificial rain-storm, and then dried and weighed again. A special technique was used to ensure a uniform coating of the powder, and precautions were taken to avoid the error due to the slight hygroscopic properties of dry cryolite. The temperature of the " rain " was adjusted so as to be 20°C. [68°F.] at the plate, as large errors were introduced by small variations in temperature. It was found that by means of these precautions fairly accurate results are obtainable. As certain adhesives greatly lowered the suspensibility, this property was determined by frequent measurements of the two or three zones that become distinguishable when the suspension is placed in a glass tube and the sediment begins to settle. A tube 45 cm. long and of 4 mm. bore was used. Of the 31 materials examined, boiled linseed oil, tung oil, boiled fish oil, raw fish oil and raw linseed oil were in this order the only ones of sufficient adhesive value to justify their use. The boiled oils were much more effective than the raw ones ; with linseed, efficiency was nearly doubled by boiling. Treacle, sodium resinate, calcium caseinate and skim milk actually decreased adhesiveness. With natural cryolite, 0·088 cc. linseed oil per gm. gave the maximum adhesiveness, and maximum suspensibility was obtained with 0·044 and 0·088 cc., an intermediate concentration being inferior. With synthetic cryolite, the maximum of both properties was produced by 0·348 cc. oil.

The more prolonged efficacy of this combined insecticide was demonstrated in the field, but owing to frequent rains, nightly mists, wind and the growth of the maize leaves, it was not sufficient to justify the increased cost.

Hrisafi (C.). **Beitrag zur Biologie des Ulmenblattkäfers** *Galerucella luteola* **Müller.** A Contribution to the Biology of the Elm Leaf-beetle.]—*Notat. biol.* **2** no. 2 pp. 37–54, 15 figs., 3 pls., 8 charts. Bucarest, 1934.

Elms lining streets in Rumania have recently been defoliated by the adults and larvae of *Galerucella luteola*, Müll., all stages of which are described. In a thermostat at 24°C. [75·2°F.], the pre-oviposition, incubation, larval and pupal periods of this Galerucid were respectively 5·8, 5·5, 14 and 5·5 days. At 29·5°C. [85·1°F.], the life-cycle was 22·1 days. In Bucarest, the adults appear early in May, leaving their hibernation quarters when the leaves unfold. The method of oviposition on the elm leaf is described. One female laid up to 1,154 eggs, with a daily maximum of 70. The larvae, which undergo three moults, fed on the leaves of *Ulmus procera* (*campestris*), *U. glabra* (*montana*), *U. vegeta*, *U. effusa* and *U. americana*. The adults appeared to prefer the European varieties [*cf. R.A.E.*, A **20** 675], and in gardens where both European and American elms were present the former were attacked. Though 3 and 4 generations were obtained in the thermostat, there cannot be more than 2 in the field, as the life-cycle at 20°C. [68°F.], the average temperature for May–August, would require 43 days. As

oviposition extends over a period up to 35 days and incubation requires only up to 6 days, all stages of the first generation can be found together in summer at the same time as those of the second.

Tetrastichus xanthomelaenae, Rond., was reared in considerable numbers from the eggs, but appeared to effect no appreciable control in the field.

[Chorbadzhiev (P.).] **Чорбаджиевъ (П.). Die Entwickelung der angewandten Entomologie in Bulgarien.** [The Development of Applied Entomology in Bulgaria.] [*In Bulgarian.*]—*Mitt. bulg. ent. Ges.* **8** pp. 35–64, 11 pp., refs. Sofia, 1934.

This paper summarises the history of applied entomology in Bulgaria from 1902, when the first agricultural experiment station was opened, to the present day. The more important insects the bionomics of which have been studied are enumerated, and notes are given on the entomological work carried out by the experiment stations at Sofia and elsewhere and by various scientific institutions, as well as by private individuals. Over 700 species of noxious insects have been found in Bulgaria, the joint activity of which causes a considerable annual loss. The biology of some 150 of these has been studied and effective control measures worked out.

A section is devoted to a list of the chief literature dealing with applied entomology that has been published in Bulgaria, and extracts are appended from official regulations and laws concerning the establishment of the entomological service in that country.

Boczkowska (M.). **Choroby i szkodniki traw na torfach, obserwowane w latach 1928-1931 na Polesiu.** [Diseases and Pests of Grasses on Peatbogs observed in 1928–1931 in the District of Polesie.]—*Inżyn. rolna* no. 2–3 reprint 4 pp. Warsaw, 1932. [Recd. August 1934.] (With a Summary in English.)

The injurious insects found on cultivated and wild fodder grasses growing in reclaimed peat bogs in eastern Poland include larvae of the following species: *Oscinella* (*Oscinis*) *frit*, L., on *Poa palustris* and *Lolium perenne*; *Arctia caja*, L., and *Pergesa* (*Chaerocampa*) *elpenor*, L., on various grasses, where they were checked by parasites; and *Laelia coenosa*, Hb., which has not previously been recorded from Poland. This Lymantriid was so abundant in one district in 1928 and 1929 that no grass was left to be mown, but in 1930 it was checked by the flooding of the meadows in May at the time of the appearance of the larvae. These chiefly feed on *Carex*; in experiments, they readily attacked *Agrostis alba* and *Festuca rubra*, but developed with difficulty on *Phalaris arundinacea* and *Beckmannia erucaeformis* and not at all on *Phleum pratense*, *Alopecurus pratensis*, *Poa palustris* or clover.

Raucourt (M.). **Contribution à l'étude chimique et insecticide des poudrages antidoryphoriques.**—*Ann. agron.* N.S. **4** no. 4 pp. 529–553, 6 graphs, 4 refs. Paris, 1934.

In experiments in France on the control of *Leptinotarsa decemlineata*, Say, a number of arsenical dusts, mostly containing about 10 per cent. metallic arsenic, were applied to potato plants with a hand duster. With a dosage equivalent to about 45 lb. per acre (which is rather higher than that commonly used in practice), the immediate deposit formed on the leaves by acid lead arsenate and calcium arsenate dusts

averaged respectively 0·0165 and 0·0238 mg. As per sq. cm. Differences of rainfall appeared to have little effect on the amount of weathering, which remained fairly constant except on plants growing under shelter. As the deposit from various dosages tended to decrease in 2 or 3 days to a uniform level of about 0·1 mg. of the dust (0·01 mg. As) per sq. cm., there is apparently little advantage to be derived from applying quantities of dust that leave initial deposits greatly in excess of this. On the other hand, the use of smaller quantities of a dust with a higher arsenical content is limited by the difficulty of even distribution. The adhesiveness of easily wettable dusts, such as most of the commercial products on the market, is considerably increased if they are applied when the plants are wet with dew; for application on dry foliage, dusts having special adhesive qualities should be used. Sprays used at the same dosages leave deposits on potato plants uniformly superior to those left by dusts over a period of 15 days, the observed difference amounting to 20–25 per cent. [*cf. R.A.E.*, A **22** 7].

All or almost all larvae of *L. decemlineata* that fed on plants carrying a deposit of at least 0·01 mg. As per sq. cm. were killed. Below 0·009 mg., the mortality dropped to a very low percentage. No significant difference in toxicity was observed between calcium arsenate and lead arsenate, no change occurring in either of these salts even after the deposit had remained for 14 days on the plants.

Kimmich (F.). **Untersuchungen über wichtige Wertmerkmale an den durch Schädlingsbefall ihrer Nachbarn begünstigten Getreidepflanzen mit einem Beitrag über die Grösse des Fritfliegenschadens an verschiedenen Hafersorten.** [Investigations on valuable Characters found in Cereal Plants favoured by the Infestation of adjoining Plants by Pests, with a Contribution on the Extent of Injury by *Oscinella frit* to Varieties of Oats.]—*Dissert. Württ. Landw. Hochsch. Hohenheim* 1932, 60 pp., 25 refs. Stuttgart, 1933. [Recd. August 1934.]

Field experiments in Germany with several kinds of cereal crops showed that injury to individual plants by various diseases or by wireworms tends to favour the development of neighbouring plants, thus compensating in some degree for the direct loss caused. The most important character distinguishing the plants thus favoured was an increased number of stems.

The studies described in the second part of the thesis confirmed the belief that certain varieties of oats are particularly susceptible to attack by *Oscinella frit*, L., the effects being noticeable both during growth and after harvest.

Zacher (F.). **Ein neuer Schädling breitet sich aus : Der Samenzünsler, *Aphomia gularis*.** [The Spread of a new Seed Pest.]—*Mitt. Ges. Vorratsschutz* **10** no. 4 pp. 37–39, 1 fig. Berlin, July 1934.

The Pyralid, *Aphomia gularis*, Zell., first recorded from Germany in September 1932 [*R.A.E.*, A **21** 176], was observed in June 1934 to be abundant in warehouses in Hamburg in which sultanas, dried prunes, Sicilian hazel nuts, etc., were stored. The owners stated that there had been a heavy infestation in 1933. Fumigation with Zyklon or Areginal or spraying are the measures advised, supplementary measures being the use of fly-papers, adhesive bands and vacuum cleaners. The importance of immediate notification is stressed.

HOLDHAUS (K.). *Anthrenus caucasicus* **Reitt. als neuer Schädling in zoologischen Sammlungen.** [*A. caucasicus* as a new Pest of Zoological Collections.]—*Mitt. Ges. Vorratsschutz* **10** no. 4 pp. 41–43. Berlin, July 1934.

Anthrenus verbasci, L., and *A. museorum*, L., after persisting for many decades as pests in the Coleoptera collection of the Vienna Natural History Museum in spite of fumigation with carbon bisulphide, have now entirely disappeared, being replaced by *A. caucasicus*, Reitt., which was first noticed in 1910. This species is only half the size of the others, and does correspondingly less injury. As the two former still occur in other parts of the museum, their disappearance is attributed to the predacious habits of *A. caucasicus*.

As the author has found some examples of *A. caucasicus* in his own house at some distance from the museum, it may be regarded as established in Vienna. No noticeable injury was done in the house. The species has hitherto been known only from Transcaucasia [*cf. R.A.E.*, A **18** 439].

DINGLER (M.). **Zur Spargelfliegen- und Spargelkäfer-Kalamität im hessischen Spargelbaugebiet.** [On Outbreaks of the Asparagus Fly and Asparagus Beetles in the Asparagus-growing Areas of Hessen.]—*Anz. Schädlingsk.* **10** no. 8 pp. 88–95, 2 maps, 2 charts. Berlin, 15th August 1934.

The greater part of this article records the localities and acreages of asparagus cultivation in Hessen. Comparison of meteorological data for 1929–31 with records of the incidence of *Platyparea poeciloptera*, Schr., showed the dependence of this Trypetid on warm, dry weather. Two-year-old plants were those most seriously attacked. The abundance of the asparagus beetles, *Crioceris asparagi*, L., and *C. duodecimpunctata*, L., was subject to greater annual variation than that of the fly.

DÜRKOP (H.). **Frisst** *Sminthurus viridis* **Eier der Rübenfliege ?** [Does *Smynthurus viridis* eat the Eggs of the Beet Fly ?]—*Anz. Schädlingsk.* **10** no. 8 pp. 95–97, 1 fig. Berlin, 15th August 1934.

Smynthurus viridis, L., has been recorded in Holland as feeding on the eggs of the beet fly, *Pegomyia hyoscyami*, Panz. [*R.A.E.*, A **20** 711], but in the author's experiments in Germany it only gnawed the surface of the shells of living eggs and the dried remains of those from which larvae had hatched. Development is not interfered with, at any rate so long as the eggs are in the moist environment that is essential to this Collembolan.

A smaller species, *Bourletiella* (*S.*) *lutea*, Lubb. [*cf.* **22** 83], which is more common in Germany, proved even less capable of injuring the eggs.

SCHWARTZ (M.). **Auftreten und Bekämpfung des Kartoffelkäfers in Stade.** [The Occurrence and Control of the Colorado Potato Beetle at Stade.]—*NachrBl. dtsch. PflSchDienst* **14** no. 8 pp. 73–75. Berlin, August 1934.

In July 1934, *Leptinotarsa decemlineata*, Say, was discovered in a potato field at Stade on the Lower Elbe about a mile from the place where an infestation was stamped out in 1914 [*R.A.E.*, A **2** 711].

Inspection revealed it in other potato fields. Each infested field was surrounded by a trench, the sides and bottom of which were soaked with crude benzol (benzene). Each potato plant was thoroughly examined, and all stages of the Chrysomelid found were killed in tanks of crude benzol or alcohol. The plants were then uprooted and buried in trenches, both the plants and the earth being soaked with benzol. The cleared fields were then harrowed, and any tubers found were treated with benzol or heavy oil. This treatment was also applied to fields of rye in which potatoes had been grown in the preceding year. About 22,000 gals. of benzol were used. All potato fields within a 3-mile radius are being sprayed with lead arsenate (4 lb. to 100 gals.) at intervals of 10–14 days up to harvest. Outside this radius, fields are required to be sprayed by their owners, the lead arsenate being supplied free of charge.

THIEM (H.). **Zur Biologie und Bekämpfung der Napfschildlaus *Eulecanium pulchrum* King, March. (=*Lec. arion* Ldgr.) auf Koniferen.** [The Biology and Control of *Lecanium rufulum*, Ckll., on Conifers.]—*NachrBl. dtsch. PflSchDienst* **14** no. 8 pp. 75–76. Berlin, August 1934.

Since the spring of 1934, several heavy infestations of *Lecanium rufulum*, Ckll. (*Eulecanium pulchrum*, King) have occurred on hedges of yew and *Thuja* in Germany, where this scale had not previously been recorded as a pest. The outbreak is attributed to the dry winter, which weakened the plants. The heaviest, often fatal, infestations occurred on low-growing plants with shallow roots. Externally the infestation resembled that of plum, *Robinia*, gooseberry and red currants by *L.* (*E.*) *corni*, Bch. The young larvae were present in July and August on the needles. In September, after the first moult, they enter hibernation on the trunk and branches, or even on the ground in very heavy infestations, returning in spring to the needles. Males were found on yew but not on *Thuja*.

Young larvae can be controlled by a spray of 2 per cent. cotton-seed oil soap or 0·5 per cent. tar distillate. From September onwards, these strengths should be doubled. The measures primarily required, however, are watering and manuring to aid the growth of the trees.

ECKSTEIN (F.). **Zuckerrübenschädlinge und Landschaft in der Türkei** [Sugar-beet Pests and Topography in Turkey.]—*Ent. Beih. Berl.* **1** pp. 64–69. Berlin, 7th August 1934.

A description is given of the topographical and climatic conditions in Anatolia, where sugar-beet cultivation is being developed on a large scale. In the Ushak region, the mean annual temperature is 11–16°C. [51·8°–60·8°F.] and the rainfall between 14 and 30 inches. *Bothynoderes* (*Cleonus*) *punctiventris*, Germ., is the chief pest, being especially injurious after warm, dry weather in April–May, and in the steppe areas permanent infestation by it may be expected. *Pegomyia hyoscyami*, Panz., occurs locally, but is largely controlled by climate [*cf. R.A.E.*, A **17** 599]. It is favoured by the abundance of its wild food-plant, *Hyoscyamus*. Of Noctuids, *Laphygma* (*Caradrina*) *exigua*, Hb., was particularly numerous some years ago.

ZACHER (F.). **Beiträge zur Geschichte, Verbreitung und Oekologie der Vorratsschädlinge.** [Contributions to the History, Distribution and Ecology of Pests of Stored Products.]—*Ent. Beih. Berl.* **1** pp. 83–86. Berlin, 7th August 1934.

The author discusses the original geographical distribution and habitat of some of the chief insects that have become adapted to the artificial conditions of granaries, etc. [*cf. R.A.E.*, A **22** 110]. He points out that this adaptation is biologically a very recent event and is in all probability still continuing, so that the appearance of new pests of stored products is only to be expected.

THIEM (H.). **Phänographisches zur Massenverbreitung von Schildläusen.** [Phenological Notes on the Mass Propagation of Coccids.] —*Ent. Beih. Berl.* **1** pp. 90-95, 3 figs. Berlin, 7th August 1934.

In experiments in Germany on the relation of Coccids to their food-plants, a strain of *Lecanium* (*Eulecanium*) *corni*, Bch., from plum failed to infest a vigorous potted apple seedling; in the following year, however, the apple began to weaken, and *L. corni* and *Pulvinaria vitis*, L., migrating from neighbouring plants, established themselves on it and killed it. *L. corni* from plum did not succeed in infesting a vigorous grape-vine, or an ash tree growing in a very favourable situation, but ash in another locality was severely attacked by this scale. *P. vitis* from one grape-vine failed to establish itself on another. Other similar instances are mentioned.

In the field, *Chionaspis salicis*, L., was found on some trees of mountain ash [*Sorbus aucuparia*] but not on others, while of yet others only certain parts were infested. Such partial attack has also been observed in the case of *Lepidosaphes ulmi*, L., on oak, birch and mountain ash, *L. corni* on ash, and *Aulacaspis rosae*, Bch., on rose.

It is concluded that an individual plant, apparently owing to metabolic change, may pass through phases of varying susceptibility to infestation by Coccids. It is improbable that the occurrence of a susceptible phase is required for the infestation of a primary food-plant liable to attack by all stages of a given Coccid, but it would obviously promote the rapid increase of infestation.

KUNIKE (G.). **Vorratsschädlinge.** [Pests of Stored Products.]—*Ent. Beih. Berl.* **1** pp. 96–99. Berlin, 7th August 1934.

Of 367 samples of cereals received from different parts of Germany, following an appeal in connection with the campaign against *Calandra granaria*, L., about 25 per cent. contained this weevil, the infestation being uniformly distributed among the various cereals, including oats [*cf. R.A.E.*, A **22** 386]. Other Coleoptera found included several species that do not normally infest stored cereals, *viz.*, *Cryptophagus cellaris*, Scop., *C. acutangulus*, Gyll., *C. scanicus*, L., *Attagenus pellio*, L., and *Mycetophagus quadriguttatus*, Müll., which has not been recorded before from grain. The Cucujid, *Silvanus* (*Oryzaephilus*) *surinamensis*, L., and the Tenebrionid, *Palorus* (*Caenocorse*) *ratzeburgi*, Wissm., were abundant in some samples; the larvae and adults of both these beetles feed on grain that has been damaged by *Calandra*.

Schleich (E. W.). **Ueber Wanderheuschrecken.** [On Migratory Locusts.]—*Ent. Beih. Berl.* **1** pp. 105–107. Berlin, 7th August 1934.

Locust invasions in Hungary, Italy and Asia Minor have been found to occur at intervals of 11 years. In China, there have been 173 invasions during a period of 1,924 years, *i.e.*, at intervals of 11·1 years. This periodicity corresponds to that of the sun-spots, but the connection is probably indirect. In Argentina, increases in locust numbers coincide with increases in agricultural productivity, suggesting that both are subject to the same, probably climatic, influence.

The limits of the distribution of locusts are about 55°N. Lat. and 40°S. Lat. They do not breed in regions where the temperature is below 18°C. [64·4°F.] during the coldest month, or where rainfall is sufficiently abundant or scarce for the appearance of tropical forests or deserts respectively.

Zacher (F.). **Die Fauna der Drogenbazare in Cairo.** [The Fauna of the Drug Bazaar in Cairo.]—*Ent. Beih. Berl.* **1** pp. 107–108. Berlin, 7th August 1934.

This brief list of insects found in the shops of the Cairo drug bazaar includes the following less usual species : *Pseudopachymerus lallemanti*, Mars., abundant in pods of *Acacia* ; *Lyctus africanus*, Lesne, of which this is apparently the first record in Egypt, infesting ginger and other drugs ; and *Attagenus alfierii*, Pic, which may have fed on the remains of other insects.

Werth (E.). **Der Generationswechsel der *Blastophaga*-Gallwespe im Zusammenhang mit der Entwicklung der Kultur- und Wildfeige.** [The Number of Generations of *Blastophaga psenes* in Relation to the Development of cultivated and wild Figs.]—*Ent. Beih. Berl.* **1** pp. 113–117, 6 figs. Berlin, 7th August 1934.

Investigations in 1931–32 in Italy confirm the established view that *Blastophaga psenes*, L., has three generations adapted to the three flower generations of the fig [*cf. R.A.E.*, A **8** 534].

Örösi-Pál (Z.). **Ueber die Ernährung der *Acarapis*-Milben der Honigbienen.** [On the Food of the Honey-bee Mites.]—*Ent. Beih. Berl.* **1** pp. 136–138. Berlin, 7th August 1934.
Experiments on the Feeding Habits of the *Acarapis* Mites.—*Bee World* **15** no. 8 pp. 93–94. Camberley, Surrey, August 1934.

In these papers, the author briefly outlines the problems connected with the parasitism of bees by *Acarapis* [*cf. R.A.E.*, A **22** 266 ; etc.]. In experiments in Germany to determine the feeding habits of the typical *A. woodi*, Rennie, and the race *externus*, Morgenthaler, a concentrated solution of Congo red was injected into infested bees. This stain proved harmless to the bees and to the mites. It was clearly visible in the former, and later was observed in adult and larval mites, by which it was partly absorbed, so that it stained the whole body. These experiments show clearly that both races suck the blood of the host.

Hering (M.). **Zwei neue Microlepidopteren aus Italien.**—*Boll. Lab. Ent. Bologna* **5** pp. 104–108, 3 figs. Bologna, 25th February 1933.

One of the new Tineids here described from Italy is *Sophronia grandii* infesting wheat. A key is given to the palaearctic species of *Sophronia*.

Venturi (F.). **Contributo alla conoscenza dell'entomofauna del frumento. (Nota preventiva.)**—[A Contribution to the Knowledge of the Insect Fauna of Wheat. Preliminary Note.]—*Boll. Lab. Ent. Bologna* **6** pp. 231–238. Bologna, 25th April 1934.

In this preliminary paper, the author summarises his laboratory and field observations during two years on insects infesting wheat in the neighbourhood of Fano and Bologna. The 32 species observed are arranged according to the part of the plant attacked, and a brief biological note is given on each, any parasites found being mentioned. The species comprise 18 Rhynchota, 3 Coleoptera, 4 Lepidoptera, 6 Diptera, and the sawfly, *Dolerus gonager*, F. The larva of *Sophronia grandii*, Hering [see preceding abstract] lives in a case formed by rolling back a leaf longitudinally and feeds on the mesophyll and the inner epidermis. In April it migrates to form a second case, eventually pupating either there or in another leaf similarly rolled.

Roubaud (E.). **Quelques données sur la biologie de** *Schistocerca peregrina* **d'après les élevages expérimentaux. Influence de l'anhydrobiose dans le cycle annuel de l'espèce et le déterminisme du comportement grégaire.**—*Bull. Soc. Hist. nat. Afr. N.* **25** no. 5 pp. 138–144, 12 refs. Algiers, May 1934.

On the basis of his experiments [*R.A.E.*, A **21** 326], the author holds the view that the swarming phase of *Schistocerca gregaria*, Forsk. (*peregrina*, Ol.) normally produces one generation a year in North Africa and the French Sudan. Two populations probably exist, one in the northern Sahara, which invades Tunisia, Algeria and Morocco [*cf.* **22** 45], and another further south, which invades the Sudanese zone. These populations are separated by the Sahara, and the swarms belonging to them migrate between the more humid areas, where they reproduce, and the desert, where they undergo a resting period. The physiological necessity for such a resting period is suggested by experiments in which only three successive generations could be obtained under conditions of constant high temperature and humidity, the third succumbing to infectious diseases without reaching sexual maturity. On the other hand, a fourth generation could be obtained if a resting period was introduced in the second. A variation towards the solitary phase was observed in locusts bred without a resting period, and it is suggested that this phase is an expression of weakened metabolism, due to continuous development without a rest. The gregarious phase is maintained by the resting period in the desert to which the swarms migrate, where the dry conditions and cold nights not only arrest sexual development but also cause the physiological reactivation of the organism.

Dozier (H. L.). **Descriptions of New Genera and Species of African Aleyrodidae.**—*Ann. Mag. nat. Hist.* (10) **14** no. 80 pp. 184–192, 2 figs., 2 pls. London, August 1934.

The new Aleurodids, the pupal cases of which are described, include *Africaleurodes coffeacola*, gen. et sp. n., from coffee (*Coffea robusta*), and *Corbettia millettiacola*, gen. et sp. n., from a leguminous shrub (*Millettia versicolor*) thought to contain rotenone, both in the Belgian Congo.

[Watson (J. G.).] **Jelutong. Damage by Insects and Fungi.**—*Malay. For.* **3** no. 3 pp. 133–137. Kuala Lumpur, July 1934.

Untapped trees of jelutong [*Dyera costulata*], grown in Malaya for timber and as a source of latex for chewing-gum, etc., are usually free from attack by insects, including termites, although the timber is very liable to termite injury. Tapped trees, however, are often seriously damaged by boring Coleopterous larvae, especially those of *Batocera* sp. When the eggs of this Lamiid are laid in a crack in a recently tapped area, where the exudation of latex is negligible, the larvae are able to penetrate and establish themselves beneath the cambium. After hollowing out a shallow but extensive depression in the sapwood beneath the occluded bark, they start to burrow downwards into the wood, and it is generally not till this stage that the frass thrown out from their workings enables infestation to be detected. By this time, the main damage to the tapping panel has been done and an ideal feeding ground has been provided for other harmful insects (including Brenthids, Platypids and weevils) that would otherwise have been unable to gain an entry. The coating of coagulated latex that covers the panel as a result of upward tapping affords some protection, but this method is uneconomical, and if the larvae hatch before the latex has covered the site, they are able to thrive in its shelter. The lower part of the trunk generally suffers most, because it is the least protected by latex after the tree has been in tapping for some time and the greater humidity, lack of light and poor circulation of air in the undergrowth are favourable to the Lamiid and hinder occlusion of bark. Trees in clearings suffer less, and undergrowth should always be cut back and the tapping panel exposed. Antiseptic dressings applied as repellents interfere with the tapping routine or taint the latex, and those actually toxic to insects are injurious to the cambium. Injury to growing trees is usually confined to the neighbourhood of the tapping wounds, and even felled trees on which the bark is intact resist attack for at least six months, during which they continue to exude latex.

Davidson (J.). **The Wandering Grasshopper.**—*J. Dep. Agric. S. Aust.* **37** no. 11 p. 1398. Adelaide, 15th June 1934.

Notes are given on the bionomics of *Chortoicetes terminifera*, Wlk. [*cf. R.A.E.*, A **22** 378], local outbreaks of which occurred in the autumn of 1934 in South Australia further south than its normal range. It is is not known whether the overwintering eggs are able to survive the cold, wet conditions of this region, but it is suggested that observations on the hatching of the hoppers should be made from about the end of August to ascertain the probable abundance of the grasshoppers in the summer of 1934–35 and the need for control measures [*cf.* **22** 477].

Quinn (G.). **Borers in Stone Fruit Trees.**—*J. Dep. Agric. S. Aust.* **37** no. 11 pp. 1404–1406. Adelaide, 15th June 1934.

An account is given of the habits and control of *Cryptophasa unipunctata*, Don. [*cf. R.A.E.*, A **22** 83 ; etc.] in South Australia, and the adult is briefly described. In the early stages, the larvae can be removed from their shallow tunnels in the trunks of stone fruit trees by means of a knife or scraping tool, and the wound can then be covered with Stockholm tar or old paint. In addition to other methods of fumigation [*cf.* **21** 30], a cotton-wool plug soaked in petrol and sealed in the tunnels is reputed to kill the borers. The varieties of almond grown in South Australia are apt to exude gum, which encourages oviposition.

Turnbull (J.). **New Type of Spray for Fruit Trees.**—*J. Minist. Agric.* **41** no. 5 pp. 433–435, 1 pl. London, August 1934.

In continuation of previous work [*R.A.E.*, A **22** 175], an existing type of fixed double nozzle of the common disk pattern was modified so that the spray starts to widen at less than 1 ft. from the nozzles, where the two sprays meet, and attains a width of 2 ft. at less than 3 ft. from the nozzles, which is maintained throughout its length. The length varies with the pressure and also apparently with the capacity of the pump, being about 15 ft. with a good 4-h.p. outfit at a pressure of 250 lb. per sq. in. This fixed double nozzle has proved satisfactory in Britain on fruit trees from 10 to 30 ft. high with lances of 2 and 6 ft. Disks suitable for light and for wetting sprays are recommended, and the details of construction are described and illustrated.

Myers (J. G.). **The Discovery and Introduction of the Amazon Fly. A new Parasite for Cane-borers** (*Diatraea* **spp.**).—*Trop. Agriculture* **11** no. 8 pp. 191–195, 5 refs. Trinidad, August 1934.

Metagonistylum minense, Tns. (Amazon fly) was discovered in 1932 at Santarem, Brazil, attacking *Diatraea saccharalis*, F., in beds of floating grasses (*Paspalum repens* and *Echinochloa polystachya*), and has since been successfully introduced into British Guiana [*cf. R.A.E.*, A **22** 388]. In Brazil, the degree of parasitism varied greatly in different places, ranging from 10 to 40 per cent. in *P. repens* under apparently similar conditions. The abundance of the Tachinid was negatively correlated with that of *Stomatodexia diadema*, Wied., possibly owing to direct competition, though only one host larva was found parasitised by both species. Though this Dexiid effected as much as 33 per cent. parasitism in certain associations, its introduction into British Guiana has, in view of this possibility, been provisionally postponed, especially as a strain of the species occurs there already in some districts (though apparently never in wild grasses) without being effective [*cf.* **13** 345]. A Pteromalid and two Encyrtids were reared from puparia of *M. minense*. As one of the latter also attacked *S. diadema*, it may be already present on this host in British Guiana. *M. minense* may also have been affected by competition with *Paratheresia claripalpis*, Wulp, and *Microdus stigmaterus*, Cress., the two other chief parasites of *Diatraea* on the Amazon, but these are of little importance in the cane fields in British Guiana.

One female of the Tachinid deposits 500–700 larvae, which usually kill those of the host when the latter are fully fed. The pupal period lasts 8½–9 days in Brazil. In addition to *D. saccharalis*, the preferred host, this parasite also attacks an unnamed species of *Diatraea*, but was never found parasitising *D. canella*, Hmps., and only did so infrequently in tests.

The methods adopted for transporting the puparia to British Guiana are described. Large numbers of flies have been reared there [**22** 388], and many liberations have been made, with the result that, only 6½ months after the first experimental consignment had been despatched from Brazil, numbers of the Tachinid had been recovered on 6 estates.

Ballou (H. A.). **Notes on some Insect Pests in the Lesser Antilles.**—*Trop. Agriculture* **11** no. 8 pp. 210–212, 5 refs. Trinidad, August 1934.

The larvae and adults of *Xyleutes* (*Duomitus*) *punctifer*, Hmps., which has been a pest of whitewood (*Tecoma leucoxylon*) for the last thirty years in Barbados and St. Kitts, are briefly described. Both sexes are positively phototropic. The eggs are laid on or in small twigs, and the newly hatched larvae bore into the centres of the twigs and then work their way down to the larger branches. They pupate near the surface, leaving only a thin layer of bark through which the pupa breaks before the adult emerges. The injury to the branches often results in death or breaking at the weakened points. In Barbados [*cf. R.A.E.*, A **10** 289; **11** 162; **13** 425], this Cossid also attacks *Gliricidia*, camphor [*Cinnamomum camphora*], *Citrus*, croton [*Codiaeum*], soursop [*Anona muricata*], *Ipomoea* and Barbados cherry [*Malpighia*]. Other recorded food-plants are sapodilla [*Achras sapota*] (in Montserrat), guava (in St. Lucia), *Pithecolobium* and *Tabebuia pentaphylla* (in St. Vincent), rose-apple [*Eugenia jambos*] and sweet almond (in Porto Rico), and possibly coffee (in Nevis). All infested branches should be cut, and all prunings and fallen branches should be burnt immediately. Where it is inadvisable to cut larvae out of larger branches, they may be killed by probing their tunnels with stiff wire.

Attempts in 1910 and subsequent years to establish the predacious wasp, *Polistes annularis*, L., in Montserrat, St. Lucia and Antigua for the control of *Alabama argillacea*, Hb., on cotton were unsuccessful, owing to the destruction of larvae in the nests by *Chalcoëla* (*Dicymolomia*) *pegasalis*, Wlk. [*cf.* **7** 415; **18** 300]. This Pyralid is probably responsible for the scarcity of *P. crinitus*, Felt., in the Leeward Islands and of *P. annularis* and *P. bellicosus*, Cress., in many parts of Barbados. In St. Vincent, there is no record of *C. pegasalis* and there has been no diminution in the numbers of *P. annularis*. These wasps are apparently the chief natural enemies of *A. argillacea* in these Islands, where it probably occurs only as a migrant from South America.

The present distribution of *Euscepes batatae*, Waterh., and *Cylas formicarius*, F., and their bionomics and control on sweet potato are discussed. *E. batatae*, which is the chief pest of this crop in the Lesser Antilles, has recently (1931) been reported from Trinidad. *C. formicarius* was first observed in St. Kitts in 1931, and has now been recorded from the Dutch Leeward Islands (Anguilla and St. Eustatius), where *E. batatae* is not known to occur.

Hammond (G. H.) & Maheux (G.). **Comment lutter contre les vers blancs dans Québec.**—*Bull. Minist. Agric. Québec* no. 130, 15 pp., 4 figs., 1 map. Quebec, 1934.

Notes are given on the bionomics of white grubs [*Lachnosterna anxia*, Lec.] in Quebec [*cf. R.A.E.*, A **15** 44], with recommendations for measures to be taken in 1934. In the zone (north of Ottawa) infested with grubs in their third year, leguminous crops [*cf.* **21** 515; etc.] should be grown for fodder in preference to cereals so as to decrease oviposition in 1935, and brushwood that might provide food for the adults should be removed from the edges of fields. In the second-year zone (extending north from Montreal), where serious injury may be anticipated, cereals or potatoes should not be grown in soil containing more than 2 grubs per sq. ft. unless it is ploughed after 15th May and then disked 4 or 5 times. In the first-year zone (including Quebec city), the adults should be destroyed by arsenical sprays applied to fruit or shade trees, by light-traps and by disking, and females may be deterred from ovipositing by the application of dusting sulphur at the rate of 300–500 lb. per acre.

Hervey (G. E. R.) & Palm (C. E.). **Non-arsenical Dusts for Cauliflower Worm Control in western New York.**—*Bull. N.Y. St. agric. Exp. Sta.* no. 640, 17 pp., 1 fig., 10 refs. Geneva, N.Y., January 1934. [Recd. August 1934.]

On cauliflowers dusted 1–5 times at various stages of growth with calcium arsenate and hydrated lime (1 : 3) against *Pieris rapae*, L., *Phytometra* (*Autographa*) *brassicae*, Riley, and *Plutella maculipennis*, Curt., in New York in 1933, large amounts of residue were found at harvest, particularly at the stump where the dust had collected in the leaf-axils. It appears that to keep the residue within the tolerance of 0·01 grain arsenic trioxide per lb., the arsenical would have to be applied about 6–8 weeks before harvest, and so would afford little protection unless supplemented by treatments with other materials.

Experiments were undertaken to compare the efficiency on cauliflowers and cabbages of various contact insecticides, the source of which is stated, reference being made to other workers' observations on their use against cabbage caterpillars. They were applied to the upper surface of the leaves (the dusts at the rate of 30 lb. per acre) on 25th July, 14th August and 8th September, and their efficiency was estimated by counting the number of living caterpillars on 25 plants taken at random in each plot 3 days after treatment. A derris powder containing 4 per cent. rotenone with talc (1 : 3 or 1 : 7) gave excellent control, the two strengths being about equally effective [*cf. R.A.E.*, A **22** 407]. In general, it was of far greater value than calcium arsenate and lime (1 : 3) and appeared about equal or slightly superior to lead arsenate and lime (1 : 3). A 1 : 1 mixture of derris containing 5 per cent. rotenone and pyrethrum containing 1 per cent. pyrethrins, diluted with 1–5 parts talc, was very toxic, but apparently inferior to derris and talc alone. The pyrethrum powder used alone or with talc (1 : 1) gave satisfactory protection, but it lost much of its toxicity when diluted with 2–5 parts talc. Good results were also obtained with "activated" pyrethrum dusts (containing 0·5 per cent. pyrethins) when used alone. Pyrethrum extract (containing 2·15 gm. pyrethrins per 100 cc.) diluted 1 : 300 with 1 oz. fish-oil soap per U.S. gal. proved less satisfactory than the dusts. Pyrethrum was not so effective as rotenone; it was more rapid in its

action [**22** 402], but protected the plants over a shorter period. Hellebore, used undiluted and with equal parts of talc, did not appear very toxic, though it compared favourably with calcium arsenate.

Pieris rapae, which was the most injurious, seemed to be the easiest species to control, and *Plutella*, which was abundant but apparently fed only on the loose leaves, was the most difficult. The larvae of these species were active from early in July until early in November and were most destructive during August-September. *Phytometra* was not sufficiently abundant to determine definitely the effect of the insecticides, though it increased considerably during September.

A derris dust containing 0·5 per cent. rotenone applied at the rate of 25–30 lb. per acre is tentatively recommended. Two applications gave adequate protection against moderate infestation in 1933, but the number will depend on the severity of infestation and the time the plants are set in the field.

SCHWARDT (H. H.). **The Saw-toothed Grain Beetle as a Rice-mill Pest.**—*Bull. Arkansas agric. Exp. Sta.* no. 309, 14 pp., 10 refs. Fayetteville, Ark., June 1934.

Silvanus (*Oryzaephilus*) *surinamensis*, L., is a major pest in rice mills in Arkansas, where its presence in stores of polished rice necessitates recleaning and repolishing. Investigations on the food preferences of the larvae [*R.A.E.*, A **21** 18] showed that they cannot develop in whole polished rice alone and that the large numbers of beetles frequently found in mills must have migrated from by-products. Development was most rapid in rice polish, but mortality was high. The larvae grow most rapidly in foods containing 11–17 per cent. water and are able to live in those having a very low moisture content. Vitamin B, which is abundant in rice polish, is apparently essential to them. A deficiency in vitamin A appears to increase the larval mortality. Infestation may be reduced by removing loose accumulations of the by-products, and prevented by storing the rice alone in a well constructed building several hundred feet from the mill. Infested material removed from the stores should be burnt periodically.

WELLMAN (F. L.). **Identification of Celery Virus i, the Cause of Southern Celery Mosaic.**—*Phytopathology* **24** no. 7 pp. 695–725, 6 figs., 24 refs. Lancaster, Pa, July 1934.

The mosaic disease of celery (*Apium graveolens*) that causes serious losses in Florida [*R.A.E.*, A **22** 132], here described as celery virus 1 has been found by juice inoculation to be transmissible to 23 species and varieties of plants, including pepper [*Capsicum*] and cucumber.

STANLEY (W. W.), MARCOVITCH (S.) & ANDES (J. O.). **A Report on the Use of Creosote Oil to control San Jose Scale and Peach Leaf Curl. (Abstract.)**—*Phytopathology* **24** no. 7 pp. 837–838. Lancaster, Pa, July 1934.

In tests during the last two years, creosote oil obtained by destructive distillation of hardwoods gave 91·09 per cent. control of the San José scale [*Aspidiotus perniciosus*, Comst.] and 96·54 per cent. control of peach leaf-curl at 8 per cent. strength, lower concentrations being less effective. Combinations of small amounts of creosote oil and mineral oil emulsion were much more toxic than either material used separately

even at higher concentrations, 1 per cent. creosote oil with 3 per cent. oil emulsion giving 99·08 per cent. control of the scale. Hardwood creosote oil and coal-tar distillate appeared to be equally toxic.

TAUBENHAUS (J. J.) & CHRISTENSON (L. D.). **Insects as possible Distributing Agents of Cotton Root Rot caused by** *Phymatotrichum omnivorum*. (**Abstract.**)—*Phytopathology* **24** no. 7 p. 839. Lancaster, Pa, July 1934.

Experiments in the United States in which *Blapstinus fuscus*, Csy., *Harpalus* sp. and larvae of other insects that normally feed on cotton were fed on plants infected with *Phymatotrichum omnivorum* showed that they did not spread this fungus.

TAUBENHAUS (J. J.) & CHRISTENSON (L. D.). **Insects as possible Distributing Agents of Cotton Wilt caused by** *Fusarium vasinfectum*. (**Abstract.**)—*Phytopathology* **24** no. 7 pp. 839–840. Lancaster, Pa, July 1934.

In experiments in the United States, insects that had fed in screened cages on various parts of cotton plants infected with wilt (*Fusarium vasinfectum*) were surface-sterilised, together with some of their faecal pellets, and cultured on nutrient agar in petri dishes. Good growth of the fungus was recovered from the following insects or their excreta : *Lachnosterna* (*Phyllophaga*) *crassissima*, Blanch., grasshoppers, *Ataxia crypta*, Say, and larvae of *Anthonomus grandis*, Boh., and *Heliothis obsoleta*, F. None was obtained from wireworms. The fungus was also recovered from all parts of the gorged alimentary canals of hoppers of *Schistocerca americana*, Drury, and larvae of *Alabama argillacea*, Hb. When, however, insects fed on infected cotton were starved for several days until all the faecal matter had been eliminated, no fungus was obtained from sections of the alimentary canal. As the fungus recovered in these experiments was capable of infecting normal cotton plants, many insects that feed on cotton may aid the spread of the disease.

CLANCY (D. W.). **The Biology of** *Tetracnemus pretiosus* **Timberlake.**—*Univ. Calif. Pub. Ent.* **6** no. 8 pp. 231–248, 5 figs., 9 refs. Berkeley, Calif., 1934.

An account is given of laboratory observations in California on *Tetracnemus pretiosus*, Timb., a parasite of *Pseudococcus gahani*, Green (citrophilus mealybug) introduced from Australia [*R.A.E.*, A **20** 22]. The host was reared on potato sprouts, the original stock being obtained from an orange orchard. The systematic position of the Encyrtid is briefly discussed, and all stages are described. The adults are positively phototropic and thermotropic ; activity is restricted in darkness and at low temperatures, and is greatest in the middle of the day and on hot days. Uninterrupted flight is seldom resorted to, but a curious hovering was occasionally observed. Adults lived 8–9 days with and about 1½ days without food (sugar-water) ; their life in the field probably averages 6–7 days. The ratio of males to females was 57·81 : 42·18. Unfertilised females produced males only. Pairing took place immediately after emergence, the males pairing several times and the females only once. The eggs were laid at random in the haemocoele of the host, one at each insertion. Oviposition occupied 2–5 seconds

and was repeated at short intervals. Preference was shown for young hosts, and most eggs were laid within a few days of pairing. Examination of ovaries indicated that the number of eggs laid by one female averages about 150. The parasite will oviposit in *P. citri*, Risso, and *P. maritimus*, Ehrh., when *P. gahani* is scarce, but the eggs or young larvae in these hosts are destroyed by phagocytosis. The egg-stage lasted 6–7 days, the three larval instars an average total of 14, the prepupal stage 2–3, and the pupal 7–9; there were more than 4 generations annually.

The distribution of *T. pretiosus* in southern California coincides with that of *Coccophagus gurneyi*, Comp. [*cf. loc. cit.*], and these two parasites together with *Cryptolaemus montrouzieri*, Muls., have resulted in almost perfect natural control of *P. gahani*. *Coccophagus* sometimes oviposits in hosts already parasitised by *Tetracnemus*; as this results in the death of the latter parasite, it may explain the predominance of the former in California. Even when hosts were scarce, *T. pretiosus* seldom laid more than one egg in each, and occasional instances of superparasitism observed are probably of no economic significance. The parasite was most effective in spring and summer.

Service and Regulatory Announcements, January–March 1934.—*S.R.A., B.P.Q.* no. 118, pp. 1–30. Washington, D.C., U.S. Dep. Agric., May 1934.

Among the recent revisions and amendments of existing orders of the United States Bureau of Plant Quarantine here given verbatim is an announcement (B.P.Q. 359) superseding previous instructions to inspectors on the treatment of plants, etc., and soil for the eradication of *Popillia japonica*, Newm. [*R.A.E.*, A **18** 354] and various supplementary recommendations [**20** 180, 681]. The dosage of naphthalene recommended [**18** 355] is now doubled; it must be uniformly distributed over the surface and mixed with the soil to a depth of 3 inches, and the land must not be disturbed for a week after treatment. The stock solution now used for carbon bisulphide emulsion is known as "50 per cent. miscible carbon bisulphide" and is composed of equal parts by volume of carbon bisulphide and castor-oil soap emulsifier [**17** 513]. It is employed both for soil fumigation and for root treatment. For the latter, metal or wooden tanks in which the liquid (45 cc. to 10 U.S. gals. water) can be maintained at about 70°F. should be provided; below 65°F. the treatment may not be effective, whereas above 70°F. the plants are liable to be injured. Plants should be dipped during the dormant period.

Miscellaneous treatments not previously noticed include the fumigation of bananas in refrigerator wagons [*cf.* **20** 180] by pouring 3 oz. liquid hydrocyanic acid out of a metal cup tipped over by a string on to each of 2 metal trays having an area of 2 sq. ft. suspended about 24 inches below the hatch openings, into which latter are fitted 4 screens made of cotton netting on light wooden frames. The temperature inside the wagon during the period of fumigation (2 hours) must be at least 75°F. The gas may also be generated by spreading 1½ lb. 88 per cent. calcium cyanide on each of two light wooden trays (6–8 ft. × 2 ft. × 2 ins.) covered with building paper, which are then placed on the load in the doorway of the wagon. The hatch openings should be covered with building paper and the door kept tightly closed for 1½ hours. Raspberries, etc., may be fumigated with 1 lb. carbon bisulphide to 100 cu. ft. in a gas-tight room at not less than 80°F. The

crates of berries should be stacked in layers separated by slats. The carbon bisulphide is poured through an outside funnel into the vapourising pan, where it is volatilised over copper coils containing water at 148–180°F., and fans are turned on to keep the gas in circulation. The water should be kept circulating through the coils for an hour. After 2 hours, the doors may be opened and the house aerated.

Plant quarantine restrictions issued by Cuba, Holland, Mexico, Chile, Cyprus and British Honduras are quoted or summarised, and a summary is given of the current quarantines relating to the European corn borer [*Pyrausta nubilalis*, Hb.] of which notices have been received from various States and from Canada.

Section of Plant Quarantine and Inspection.—*J. econ. Ent.* **27** no. 3 pp. 557–596. Geneva, N.Y., June 1934. [Recd. October 1934.]

This series of papers includes: Outbreak of an African Moth in Stored Senna, by H. B. Weiss and E. G. Rex (pp. 557–558), which records an infestation of a large quantity of senna leaves stored in New Jersey by *Tortilia* [*viatrix*, Busck] that has already been noticed [*R.A.E.*, A **22** 354] and its control by fumigation with Carboxide (a combination of ethylene oxide and carbon dioxide) at the rate of about 15 lb. to 1,000 cu. ft., with an exposure of 48 hours at 52–60°F.; Insect Findings in recent Years which are or may become of Interest to Nursery Inspectors and Plant Quarantine Officers, by J. A. Hyslop (pp. 559–566), in which brief notes are given on insect pests newly introduced into the United States, recently described native species, and species long known to the fauna that have only recently assumed economic importance, records of which have been obtained during the past few years by the Insect Pest Survey; The European Earwig [*Forficula auricularia*, L.] as a Pest in Rhode Island, by A. E. Stene (pp. 566–569), which includes notes on the amount of bait used in its control from 1925 to 1931; The new Outbreak of the Dutch Elm Disease, by R. K. Beattie (pp. 569–572), which summarises the results of scouting in 1933 for elms infected with *Graphium ulmi* [*cf.* **22** 392, etc.], of which 762 were found in New Jersey, 83 in New York, 1 in Connecticut, 1 in Maryland and 1 in Ohio; Additional Inspection of Nurseries on Account of the European Pine Shoot Moth [*Rhyacionia buoliana*, Schiff., in Connecticut], by W. E. Britton (pp. 572–574); Plant Quarantine Legislation supported by numerous Court Decisions, by S. B. Fracker (pp. 574–580); Some Peculiarities of State Regulations concerning the Movement of Nursery Stock, by A. G. Ruggles (pp. 581–584); Gipsy Moth [*Porthetria dispar*, L.] Work west of the Connecticut River and in Pennsylvania and New Jersey in 1933, by A. F. Burgess (pp. 585–589); Proceedings National Plant Board Meeting (pp. 589–590); Proceedings of the Southern Plant Board (p. 590); and Report of the Western Plant Quarantine Board, by A. C. Fleury (pp. 590–594).

Section of Apiculture.—*J. econ. Ent.* **27** no. 3 pp. 596–668. Geneva, N.Y., June 1934. [Recd. October 1934.]

This series of papers includes the following: Spray Poison in the Yakima Valley, by R. L. Webster and A. Crews (pp. 614–617), which gives an account of injury caused to bees in Washington by lead arsenate sprays applied to potato plants against the Colorado potato beetle [*Leptinotarsa decemlineata*, Say]; The Effect of Colony Size on the

Flight Rates of Honeybees during the Period of Fruit Bloom, by A. W. Woodrow (pp. 624–629); and Studies in the Number of Ovarioles in Queen Honeybees in Relation to Body Size, by J. E. Eckert (pp. 629–635).

Section of Extension.—*J. econ. Ent.* **27** no. 3 pp. 669–702. Geneva, N.Y., June 1934. [Recd. October 1934.]

This series of papers includes: Problems of the Extension Entomologist, by H. E. Hodgkiss (pp. 669–676), in which the author discusses the organisation of extension work, the acquisition of data on insect control, and the correct evaluation of the results of investigations and of extension activities; Methods of conducting Extension Work, by C. R. Crosby (pp. 677–678), which deals mainly with the yearly issue in bulletin form of instructions to growers in New York State, based upon the annual conference of extension workers and investigators, and with summaries of weekly reports published from April to August for the distribution of information of immediate value; Extension Activities in the Entomological Program for Delaware, by L. A. Stearns (pp. 679–686); Aims and Purposes of Extension Work in Entomology, by A. B. Graham (pp. 685–686), in which the adaptation of accurate information for public use is discussed; and Popularizing Entomology, by B. Adams (pp. 687–694), which insists on the necessity of keeping entomology before the public and of writing and speaking about it in simple, non-technical language.

Cowan (F. T.). **Application of the Variance Method to the Comparison of Grasshopper Baits.**—*J. econ. Ent.* **27** no. 3 pp. 705–713, 5 refs. Geneva, N.Y., June 1934. [Recd. October 1934.]

Statistical methods for the analysis of data collected from comparative experiments on a number of small plots are discussed generally from the literature [*R.A.E.*, A **12** 306; **18** 685; **20** 25], and attention is drawn to a variance method for calculating standard error, the use of which is illustrated in a comparison of grasshopper baits. In a series of tests carried out in Colorado in 1931, 12 baits were used, most of them consisting of bran, arsenic and water (the basic formula) in combination with various materials. The baits were scattered early in the morning on plots of uniform size, and sweepings were made at a specified time during the afternoon of the same day and the grasshoppers placed in wire screen cages for observation. Dead individuals were removed each day and their numbers recorded. After the third or fourth day, the surviving grasshoppers were removed and their numbers noted. The total number caged and the percentage of kill for the test were then computed.

The data secured indicate that salt is not necessary in grasshopper baits in Colorado. The bait containing salt only in addition to the basic formula ranked well below the latter alone. Although baits containing salt and amyl acetate as well as molasses gave better results than the basic formula alone, the difference, which was not significant, was probably due to the presence of the other ingredients. Amyl acetate appears to be necessary when beet molasses is used, but does not appear of benefit in combination with cane molasses. The data further indicate that there is no practical substitute for bran, two commercial baits tested giving results proportionate to the amount of

bran contained in each. Dried beet pulp, however, appears to have possibilities as a substitute for bran, and tests of this material in combination with other attractants are recommended.

BLANTON (F. S.) & SPRUIJT (F. J.). **Egg Deposition of the Lesser Bulb Fly** (*Eumerus tuberculatus* **Rond.**).—*J. econ. Ent.* **27** no. 3 pp. 713–715. Geneva, N.Y., June 1934. [Recd. October 1934.]

At the beginning of a study in New York on the relation of *Eumerus tuberculatus*, Rond., to basal rot (*Fusarium*), females of this Syrphid introduced into cages containing narcissus bulbs infected with the fungus laid few or no eggs. Later in the spring of 1932, after the leaves had been injured at ground level by the application of ammonium thiocyanate, carbon bisulphide or carbon bisulphide emulsion to the soil against nematodes, numerous eggs of *Eumerus* were found on the injured parts. Bulbs, growing in pots or in the open, artificially injured by means of these chemicals were all infested with *Eumerus* larvae after 4 weeks, whereas uninjured bulbs remained uninfested.

It was then found that females collected in the field after a rainy spell, during which they had been inactive, laid numerous eggs in test tubes, particularly on the cotton plugs with which these were stoppered. Further observations showed that they began to oviposit at once or not at all and usually laid all their eggs with a few hours. Almost half the females were observed to lay eggs, the maximum number laid by an individual being 143. This method was finally adopted as the most convenient for obtaining eggs. In subsequent observations on 90 flies confined in test tubes between 15th June and 29th August, the average number laid per fly was 32·2. The behaviour of females during oviposition in the field is described. Several flies will lay eggs on the same bulb.

KNULL (J. W.). **The Southern Pine Beetle in Pennsylvania** (*Dendroctonus frontalis* **Zimm.**).—*J. econ. Ent.* **27** no. 3 pp. 716–718, 8 refs. Geneva, N.Y., June 1934. [Recd. October 1934.]

Dendroctonus frontalis, Zimm., was found in 1932–33 infesting pines in many areas in southern Pennsylvania (the northern limit of its range), where outbreaks have hitherto been unknown and records of capture rare. Observations of exit holes on old dead standing trees indicate that the beetle had not long been present in appreciable numbers, and it may have appeared in 1930. It is suggested that its increase was due to a lowering of the vitality of the trees by the hot dry summers of 1930 and 1931 and to a series of mild winters [*cf. R.A.E.*, A **13** 510; **19** 94; etc.].

It has been shown that temperatures as low as 10°F. for short periods result in a high mortality of the overwintering larvae. The observation that winter mortality is higher in the phloem than in the outer bark was corroborated. Trees that are growing slowly appear to suffer most, and those that had survived recent fires were often severely infested. Injury by lightning or wind apparently accounted for some isolated infestations. Pitch pines [*Pinus rigida*] containing living larvae that had survived the winter of 1932–33 were found at an elevation of about 2,900 ft. Other species infested were short-leaf pine [*P. echinata*], table mountain pine [*P. pungens*], white pine [*P. strobus*] and Virginia scrub pine [*P. virginiana*], the thickness of the bark

decreasing in the order named. No pupae were observed during the winter, but living adults and larvae were abundant in the larger pitch and short-leaf pines, winter mortality being high in the species with thinner bark. Woodpeckers had been very effective in reducing the numbers of the beetle. Many of the thick-barked pines killed by *D. frontalis* also contained larvae of the Lamiid, *Acanthocinus nodosus*, F., another southern species rare in Pennsylvania, which were unusually numerous in the parts of the bark extending just below the ground litter.

WILLIAMS (C. B.). **The European Corn Borer in Egypt.**—*J. econ. Ent.* **27** no. 3 p. 719. Geneva, N.Y., June 1934. [Recd. October 1934.]

With reference to the record of *Pyrausta nubilalis*, Hb., in Egypt in July 1933 [*R.A.E.*, A **22** 101], the author states that he found a number of the larvae in maize growing near Alexandria in 1925. An investigation in the following year when the maize was at about the same stage of growth failed to reveal the presence of a single example.

BRANNON (L. W.). **General Observations on the Lima Bean Vine Borer (*Monoptilota pergratialis* Hulst) on the Eastern Shore of Maryland during 1933.**—*J. econ. Ent.* **27** no. 3 pp. 719–720. Geneva, N.Y., June 1934. [Recd. October 1934.]

Monoptilota pergratialis, Hulst* (lima bean vine-borer), which has been present in Maryland since 1928 and has since caused a certain amount of damage each year, was responsible in 1933 for the most severe injury yet observed there. Larvae obtained on 21st June by splitting the stems of lima bean plants pupated in the laboratory on 3rd July, the adults emerging on 13th July. On 21st September, larvae were present in the field inside most of the stems, as many as three being found in one stem. These pupated in the insectary on 25th September. Examinations made on 16th March 1934 showed that the pupae hibernate on or near the soil surface.

The larvae burrow in the stalk and cause gall-like swellings, weakening the plants so that they soon wither and are easily broken by the wind. When full-grown, they bore exit holes in the stem and drop to the ground, where they pupate in silken cocoons covered with earth. It appears that at least two generations develop in Maryland in one season. Damage seems to be more severe in light sandy soils. Autumn ploughing and cultivation would probably be of value in controlling this Pyralid.

KNOWLTON (G. F.). **An insectivorous Range Lizard in Pasture Control.**—*J. econ. Ent.* **27** no. 3 p. 720. Geneva, N.Y., June 1934. [Recd. October 1934.]

The numbers of insects found in the stomachs of 318 individuals of *Sceloporus graciosus*, a common lizard in pastures in Utah, are recorded under their Orders. Injurious species included Aphids and other Rhynchota [*cf. R.A.E.*, A **22** 88], grasshoppers and Lepidopterous larvae. Although 30 examples of predacious species had been ingested, the bulk of the recognisable forms were either injurious or of no known economic importance.

* Possibly the moth recently recorded as *M. nubilella*, Hulst [*R.A.E.*, A **22** 300].—Ed.

BARE (C. O.). *Tortrix ivana* **Fernald, a Celery Pest in the Everglades of Florida.**—*J. econ. Ent.* **27** no. 3 pp. 720–721. Geneva, N.Y., June 1934. [Recd. October 1934.]

Eggs and larvae of *Tortrix ivana*, Fern., were discovered on 16th January 1933 in a celery field in Florida. In the laboratory, *Trichogramma minutum*, Riley, emerged from the eggs, and two other, undetermined, Hymenoptera from the larvae. The tops of the younger celery, on which an average of two larvae per plant were present, were wrinkled and curled. About one-sixth of the stalks of the nearly mature celery, especially on one side of the field, were so badly damaged as to be unmarketable. The small larvae first fed on the leaves beneath their webbing and later migrated downward to the heart of the plants, attacking the inner surfaces of the petioles where the damage became commercially serious. The injury to the petioles resembled that caused by cutworms, except that the larvae fed beneath a thin, tough, white web and produced considerable frass. A number of the larvae were taken on *Gnaphalium obtusifolium*, which grows commonly in the infested areas. Although not at present abundant in outlying fields, *T. ivana* is likely to become a pest of major importance if celery-growing is concentrated in large areas.

Occasional larvae of *T.* (*Cacoecia*) *rosaceana*, Harr., and *T.* (*C.*) *obsoletana*, Wlk., have also been taken on celery in Florida.

CHAPIN (E. A.). **The known Distribution and Habits of** *Plectris aliena* **Chpn.**—*J. econ. Ent.* **27** no. 3 pp. 721–722. Geneva, N.Y., June 1934. [Recd. October 1934.]

Plectris aliena, Chapin, a recently described Melolonthid probably indigenous to northern South America, is now established in the eastern United States, the point of greatest abundance being Charleston, South Carolina, where it is very common in lawns. It has recently been taken in traps in Georgia (where considerable injury to golf links is reported in one district) and Florida. It seems to have one generation a year, being active from March to July. Pupation and oviposition occur about 11 inches beneath lawn turf. Males emerge from the ground at dusk and after flying rapidly for about 20 minutes return to the soil. None was collected at street lights or in adjacent shrubberies.

EYER (J. R.). **Further Observations on Limiting Factors in Codling Moth Bait and Light Trap Attrahency.**—*J. econ. Ent.* **27** no. 3 pp. 722–723. Geneva, N.Y., June 1934. [Recd. October 1934.]

In New Mexico, bait pans [*R.A.E.*, A **21** 450] and light-traps hung in the western, south-western or north-western side of individual apple trees or plots, where they were more exposed to prevailing westerly winds and sunset light intensity, caught larger numbers of the codling moth [*Cydia pomonella*, L.]. The following observations agree with those made in other States : about 55 per cent. of the moths caught in either kind of trap are males ; flight is inhibited by nocturnal temperatures above 80 or below 60°F ; the moths are most active at sunset and at sunrise, when 60–70 and 15–20 per cent., respectively, are in flight ; they are active at light intensities of approximately 30–50 foot candles. In connection with the last point, it has been observed that artificial lights producing this range of intensity prolong flight periods and consequently visits to baits used in conjunction with them. Lights of greater or less intensities exerted slight effect or were repellent.

FLANDERS (S. E.). **The Life Histories of three newly imported Predators of the Red Scale.**—*J. econ. Ent.* **27** no. 3 pp. 723–724. Geneva, N.Y., June 1934. [Recd. October 1934.]

The immature stages of the Coccinellids, *Pharoscymnus horni*, Wse., and *Telsimia emarginata*, Chapin, and a Nitidulid, *Cybocephalus* sp., which were introduced into California from eastern Asia in 1933 for the control of *Aonidiella* (*Chrysomphalus*) *aurantii*, Mask. (citrus red scale), are briefly described. These insects have been reared in large numbers in the insectary, but have not been recovered after liberation in the field. The eggs of *T. emarginata* are usually deposited in crevices, but may often be observed on the surface of the Coccid or its food-plant; the full-grown larvae usually migrate downward and pupate in crevices. The eggs of *P. horni* are deposited in crevices or débris, and the larvae attach themselves to the lower surfaces of the plant for pupation. The eggs of *Cybocephalus* are deposited in the vacated male scales or beneath the mature female scales; about 4 days before pupation, the larva spins a round cocoon in the soil or débris, where the adult remains 3 days before cutting its way out of the cocoon. In the laboratory, at a fairly constant temperature of 82°F., the durations of the stages were as follows:—*P. horni*, egg 8 days, larva 11, prepupa 2, pupa 5; *T. emarginata*, egg 5 days, larva 20, prepupa (?) 6, pupa 5; *Cybocephalus*, egg 5½ days, larva 7, prepupa 4, pupa 7.

WELLMAN (F. L.). **A Disease of Banana, markedly similar to Bunchy Top, produced by Celery Virus 1 in U.S.A.**—*Phytopathology* **24** no. 9 pp. 1032–1034, 1 fig., 4 refs. Lancaster, Pa, September 1934.

In the course of investigations on a disease of banana (*Musa sapientum*) in the United States caused by Celery Virus 1 [*R.A.E.*, A **22** 569] and producing symptoms resembling those of bunchy-top, examples of *Aphis gossypii*, Glov., and *A. maidis*, Fitch, were allowed to feed for two weeks on infected shoots of *Commelina nudiflora*, and then caged in batches of 75–150 on banana leaves. The former transmitted the disease to 13 out of 15 plants, and the latter to both those used, the symptoms appearing after 21–33 days. Plants infested with Aphids from healthy *Commelina* did not become diseased. Infected Aphids placed on healthy *Commelina*, cucumber or celery always produced typical symptoms of the virus, which was readily recovered either by rubbing expressed juices on cucumber cotyledons or through transmission by *A. gossypii*. It was, however, impossible to recover the virus from diseased banana by either method. Juices from diseased or healthy banana leaves were highly toxic to celery and cucumber seedlings. The disease was also transmitted to two plants of *M. cavendishi* by *A. gossypii*, becoming apparent after 30 days.

WELLMAN (F. L.). **Infection of *Zea mays* and various other Gramineae by the Celery Virus in Florida.**—*Phytopathology* **24** no. 9 pp. 1035–1037, 1 fig., 4 refs. Lancaster, Pa, September 1934.

In Florida, Celery Virus 1 was transmitted from *Commelina nudiflora* and celery to maize by *Aphis gossypii*, Glov., about two-thirds of the plants showing symptoms of the disease. The most rapid and severe infection occurred at 70–90°F. when 15–20 infected Aphids were placed on seedlings 3–5 days after they appeared above ground. Feeding was

at first confined to the new, first seedling leaf, and primary lesions appeared in 3 days round feeding punctures. The celery virus causes a stripe disease of maize in Florida, which is transmitted by Aphids and resembles the white-stripe of maize in Cuba. On a visit to this Island, the author observed typical symptoms of Celery Virus 1 on celery, squash, cucumber and other plants. Maize in fields planted later than the vegetables was found to be infected with white-stripe, but not with the celery virus.

Woglum (R. S.), La Follette (J. R.), Landon (W. E.) & Lewis (H. C.). **Handbook of Citrus Insect Control for 1934.**—*Bull. Calif. Fruit Gr. Exch.* no. 11, 29 pp. Los Angeles, Calif., July 1934.

Recommendations are given for the control of mites and insects, chiefly Coccids, attacking *Citrus* in numerous districts in California in 1934. There was a widespread increase during the preceding season of *Saissetia oleae*, Bern., and *Aonidiella* (*Chrysomphalus*) *aurantii*, Mask., and heavy infestations of the latter may develop under favourable conditions. *Paratetranychus citri*, McG., was present throughout the year and extended control measures were necessary. *Aphis gossypii*, Glov., *A. spiraecola*, Patch, *Tortrix citrana*, Fern., and *Holcocera iceryaeella*, Riley, caused severe damage in some districts. The two latter may be controlled by a spray of 3 lb. cryolite, 1 U.S. pint mineral oil and $\frac{1}{3}$ U.S. pint liquid albumen (or 4 oz. dry blood albumen) in 100 U.S. gals., or a dust of cryolite, talc and mineral oil (10 : 9 : 1). These should be applied not earlier than April or May against *Tortrix* and in September or October against *Holcocera*. The spray is more expensive, but it gave better control and may be combined with the mineral oil spray against Coccids. The unusually mild weather was probably the chief cause of local outbreaks of the long-tailed mealybug [*Pseudococcus adonidum*, L.], which is not ordinarily a pest of *Citrus* and does not appear to be attacked to any great extent by *Cryptolaemus* [*montrouzieri*, Muls.], and of *Phylloccoptes oleivorus*, Ashm., and armyworms, which last usually occur sporadically and not in successive years. In fumigation with hydrocyanic acid gas, it was found better to begin on the side of the plantation sheltered from the wind, so as to prevent the " protective stupefaction " of Coccids [*cf. R.A.E.*, A **18** 41 ; **22** 99] by gas leaking from the tent.

Various pests and insecticides are dealt with specifically, and a list of proprietary mineral oil sprays for use on *Citrus*, showing their chief chemical and physical properties, is appended.

Hinds (W. E.), Osterberger (B. A.) & Dugas (A. L.). **Sugar Cane Moth Borer Control by *Trichogramma minutum* Riley. Report on Experimental Work for 1933.**—*Bull. La agric. Exp. Sta.* no. 248, 34 pp., 4 graphs, 1 ref. [Baton Rouge, La] May 1934. [Recd. August 1934.]

Data obtained in Louisiana in 1933 on the effect of liberating *Trichogramma minutum*, Riley, for the control of *Diatraea saccharalis*, F., largely confirmed previous conclusions [*R.A.E.*, A **21** 225]. Occasional adults of *Trichogramma* were observed among evergreen shrubs as early as January, but no evidence could be obtained that they hibernate in sugar-cane trash or that the method of disposing of this has any effect on the survival of the parasite [*cf.* **21** 656]. At the end

of January 1933, only about 40 living *Diatraea* larvae per acre were found where top trash had been thoroughly burnt in that month, as compared with 2,250 in unburnt areas. These numbers were considerably reduced by frost in February. The emergence of *Trichogramma* from eggs of *Sitotroga cerealella*, Ol., was not appreciably reduced by their sudden removal in February from the laboratory at 70°F. to an outdoor temperature of 18°F., though it was greatly retarded.

It is recommended that planters should estimate not later than February the numbers of *Trichogramma* that they are likely to need, assuming that liberations will be advisable in about one-third of the total acreage of maize and one-fifth of that of sugar-cane (including particularly areas of well drained soil, or where varieties of cane specially susceptible to the borer are grown). About 6,000 parasites (costing about 4*s*. [at par]) will be required per acre in June, and (if a second or third liberation is necessary) about 10,000 after 1st August. It is suggested that half the total required should be delivered to the planter about 10th June, another quarter on 1st July and the remainder on 20th July. If desirable, the parasite stock may be stored for a few weeks at 40–50°F. As a working rule, liberation is justified when and where three or more batches of unhatched *Diatraea* eggs can be found in an hour, or where at least one dead-heart caused by the borer occurs in 25 feet of row when the proportion of pupal skins to pupae and full-grown larvae together is not less than 1 : 10. Under these conditions, liberation may reasonably be expected to reduce loss by one-third. The demand for *Trichogramma* in Louisiana is increasing, and though it cannot be expected ever to effect complete control, it appears to afford a practicable and profitable means of reducing infestation.

Canada. Regulations under the Destructive Insect and Pest Act.—*A.O.R.* no. 8 4 suppl. each 1 p. Ottawa, 9th May 1934.

Regulations nos. 10 (Domestic) and 19 (Foreign) prohibiting the importation into British Columbia of *Gladiolus* from the other Provinces of Canada and from the United States, respectively, on account of *Taeniothrips gladioli*, Moult. & Stnw. [*R.A.E.*, A **20** 353, 431] are rescinded. In addition to the previous provisions of Regulation no. 14 (Foreign) [**16** 572], the 5th revision prohibits the importation into Canada from the United States of peach and nectarine stock, including any tree or shrub grafted or budded on peach or nectarine roots, except under certificate that it has been inspected and found free from phony peach disease and from *Aegeria* (*Synanthedon*) *exitiosa*, Say. Regulation no. 21 (Foreign) prohibits the importation into Canada of plant pests and all living insects (other than honey-bees) except under permit. All these enactments came into force on 9th May 1934.

Ruhmann (M. H.). **Report of the Provincial Entomologist.**—*Rep. Dep. Agric. Brit. Columbia 1933* **28** pp. Y39–Y40. Victoria, B.C., 1934.

Insects that were numerous in various localities in British Columbia in 1933 included : the Geometrid, *Rachela bruceata*, Hulst, which had not occurred in appreciable numbers on fruit trees for some years ; *Taeniothrips inconsequens*, Uzel, which was recorded for the first time in one locality, where it was fairly generally distributed on pear but

caused no serious injury ; *Anuraphis roseus*, Baker, on apple ; *Rhynchites bicolor*, F., on rose in gardens ; and *Pieris rapae*, L., *Aphis pseudobrassicae*, Davis, and *Brevicoryne* (*A.*) *brassicae*, L., on crucifers. There was a slight increase of *Enarmonia* (*Laspeyresia*) *prunivora*, Walsh., on apple in one district. *Tortrix* (*Archips*) *rosaceana*, Harr., which is generally distributed on apple in the interior, is effectively controlled by a regular arsenical spray programme. A maximum of 5 sprays is recommended against the codling moth [*Cydia pomonella*, L.], comprising a calyx and 2 cover sprays for the first brood and 2 cover sprays for the second one. The substitution of 5 lb. calcium arsenate (with or without 5 lb. hydrated lime) to 80 gals. water for 3 lb. lead arsenate in the first two cover sprays resulted in 0·57 per cent. infested and 1·81 per cent. " stung " fruit on 3 average trees, as compared with 0·9 and 2·83 per cent., respectively. No scorching was caused by any of the calcium arsenate sprays.

MASSEE (A. M.). **Notes on Mite and Insect Pests for the Year 1933.**—*Rep. E. Malling Res. Sta. 1933* **21** pp. 176–180. East Malling, Kent, May 1934.

Notes are given on various pests observed in Kent and neighbouring counties in 1933. *Tetranychus telarius*, L., became conspicuous on hops [*cf. R.A.E.*, A **22** 513] about mid-July and caused considerable damage to the foliage until early September. In gardens that have been infested in the previous year, the older leaves should be examined in June, so that control measures may be undertaken before the mites have made webs on them. The females hibernate in colonies in the soil, particularly in the drier positions round the hills, the cracks of the poles (including holes deserted by a wood-boring beetle) and old leaves, etc. They are most easily found in October or November. The bine should be destroyed as soon as possible after picking, though sometimes the mites migrate to the soil during the picking operations. Infestation round the hills may be reduced by the application of 3–4 cwt. crude naphthalene per acre in September or October or about the end of February or in March. Considerable success has been obtained with a spray of ¾–1 lb. liver of sulphur (potassium sulphide) and 5 lb. soft soap in 100 gals. water applied during July and repeated twice if necessary. *Tarsonemus fragariae*, Zimm., was abnormally abundant on strawberry in June, and by mid-July numbers of young runners in many beds were being killed. The favourable season appears to have induced rapid reproduction and spread from undetected foci of infestation.

Larvae of the first brood of *Cydia* (*Laspeyresia*) *pomonella*, L., have been present, chiefly in gardens and small orchards, for many years. This Tortricid has been increasing since 1927, and the development of a second brood has become more common ; 80 per cent. of the apples in one sample were infested by these larvae, which bore into the sides of the fruit in late July and August, causing it to ripen prematurely. Many are distributed with the packed fruit and either overwinter in crevices of the packages or migrate in search of better hibernating quarters. Bands of sacking or corrugated cardboard should be placed round trees not already treated for *Anthonomus pomorum*, L., and should be removed by the end of December. *Eriosoma lanigerum*, Hsm., was commoner on apple than in any year since 1929. It was first observed in June and spread rapidly, causing damage to new growth. An application of soft soap and nicotine in late June did not

prevent re-infestation after a few weeks. Little success was obtained with a 2 per cent. summer oil, and it appears that a solvent is necessary to dissolve the woolly secretions of the Aphids before they can be killed. Where infestation is not severe, the infested patches may be painted with methylated spirits or petrol. *A. pomorum* was reported for the first time in one locality. This weevil is becoming increasingly common on one variety of apples and is attacking pears. It is sometimes more numerous on cordon apples, but also occurs plentifully in grass orchards or in those surrounded by woods. In these, banding of the trees is not always efficient, owing to the number of alternative hibernating quarters as compared with a cultivated plantation. Hedgerows and neglected overgrown ditches should be kept clean. *Hoplocampa flava*, L. [*cf.* **21** 560], which has only recently become a pest of economic importance on plums in Kent, was reported from new plantations in the spring.

Massee (A. M.). **Investigations on the Control of the Strawberry Tarsonemid Mite.**—*Rep. E. Malling Res. Sta. 1933* **21** pp. 181–187, 1 pl., 1 ref. East Malling, Kent, May 1934.

In work in south-eastern England, strawberry runners immersed on 11th October 1932 in water at 110°F. for 10 or 20 minutes [*cf. R.A.E.*, A **21** 371] and then plunged in cold water were less healthy [*cf.* **22** 517] on 12th April 1933 than those immersed in 3 per cent. lime-sulphur containing Agral I for 20 minutes or others left untreated; on 24th May, however, they were growing so fast that they appeared to be at least as vigorous as the others. The plants had been taken from beds severely infested with *Tarsonemus fragariae*, Zimm., in the summer 1932 and, in addition, had been artificially infested with 5 adult mites each. In August, those treated with hot water (particularly for 20 mins.) were comparatively free from attack, whereas about 80 per cent. of the plants treated with lime-sulphur were attacked and many of the untreated ones appeared very unhealthy. At the end of August, the superior condition of those immersed in hot water was easily discernible. By the end of September, however, the mites were present on all plants, the cause of a such a rapid increase in the autumn being unknown, particularly as the runners were removed and none of the plants in any one plot were in contact with those in adjacent ones. A survey at the end of May revealed the presence in some plots of *Lygus pabulinus*, L., and *Rhynchites germanicus*, Hbst., which severs the petioles, causing the leaves to wilt and drop off. The weevil was not observed after August. The plants treated with hot water produced about the same number of runners as the untreated ones and had a greater average spread and height in September. Observations on the incidence of "yellow-edge" disease did not indicate that *T. fragariae* is implicated in its spread [*cf.* **22** 542], as far fewer cases developed on the plants treated with lime-sulphur than on the control ones, whereas the numbers of mites were approximately the same. This investigation and other preliminary work [**21** 371], together with observations in actual plantations where the measures have been carried out on a field scale, indicate that immersion in water at 110°F. for 20 mins. should be made a routine practice for the practical grower. The treatment is best carried out during the latter part of August and September or during March–April; considerable mortality results if the plants are treated between late October and the end of February, probably owing to the fact that they remain in the soil without establishing themselves or producing roots.

Investigations were carried out in the autumn of 1932 to determine the effect of treatment for 10–20 mins. in water heated to 90–130°F. All the plants treated at 115°F. for 20 mins. were killed, and the mites and their eggs were not destroyed below 105°F. For practical purposes the temperature should range between 108 and 112°F., and 20 mins. immersion at 110°F. is the optimum. The treatment killed *Tetranychus telarius*, L. and *Capitophorus* (*Pentatrichopus*) *potentillae*, Wlk.

STEER (W.). **Studies on *Byturus tomentosus* Fabr. IV. 1933 Experiments on the Control of the Raspberry and Loganberry Beetle.**— *Rep. E. Malling Res. Sta. 1933* **21** pp. 188–196, 6 refs. East Malling, Kent, May 1934.

On raspberry canes in south-eastern England treated on 9th or 30th May with a China clay dust containing 3·7 per cent. derris (or 0·1 per cent. crude rotenone) at the rate of about 100 lb. per acre to prevent oviposition by *Byturus tomentosus*, F. [*cf. R.A.E.*, A **21** 294], the percentage of infested berries in June–July averaged 60·1 and 39, respectively, as compared with 62·7 on untreated canes. To obtain adequate control by dusting early enough to avoid leaving a deposit on the fruit, it may be necessary to apply larger quantities of a dust having a higher rotenone content. Dusts should normally be applied in absolutely calm weather during the first half of June, at the beginning of flowering, and in mid-June, at the period of maximum oviposition. On canes sprayed on 6th or 16th June or on both dates with 2 lb. derris or on 16th June with 1 lb. cubé (*Lonchocarpus*), both being used with 5 lb. soap and 100 gals. water, so that the rotenone content of the sprays was 0·0054 and 0·0064 per cent. respectively, the respective percentages of infested berries averaged 13·8, 8, 2·4 and 7·2, as compared with 63 on the controls. Differences in average infestation throughout the season of 1·9 per cent. are considered significant.

On loganberries, a single application of the derris spray on 13th June, when larval damage to the fruit became noticeable, proved the most valuable ; an additional application on 6th June, when hatching began, or on 21st June, 9 days before picking, only reduced the percentage of infested berries from 7·9 to 4·5 and 2·6 respectively, the percentage on the controls being 57·2. The addition of 2 lb. gelatine did not appear to improve a derris spray applied on 14th June.

These studies indicate that one application of derris and soap will give adequate control if applied about 3 weeks after the beginning of blossoming for raspberries and about 4 weeks after for loganberries, when the larvae begin to damage the berries (normally towards the end of June). A good deal of latitude is permissible in timing, particularly on raspberries, with which reasonably uninfested fruit can still be obtained if applications are made at the beginning of picking. To ensure the maximum control on late loganberries, the fruit may be sprayed before or about the same time as raspberries and again after 7–10 days, leaving 7–10 days before picking begins.

Early blackberries sprayed with derris on 13th June had 4·6 per cent. infested berries as compared with 80·7 on controls, and one application about 14 days after loganberries are treated appears to be adequate for the chief commercial varieties. Confirmation in the field is necessary, however, before this treatment is recommended as a substitute for the usual two sprays applied during the first and second weeks in July.

Hey (G. L.) & Steer (W.). **Experiments on the Control of the Apple Sawfly (*Hoplocampa testudinea* Klug). The Results of one Season's Field Trials and some Considerations arising from them.**—*Rep. E. Malling Res. Sta. 1933* **21** pp. 197–216, 3 figs., 11 refs. East Malling, Kent, May 1934.

For the control of *Hoplocampa testudinea*, Klug, apple trees in south-eastern England were sprayed with 2 lb. derris (containing 2·71 per cent. rotenone) or 8 oz. nicotine (95–98 per cent.), both with 8 lb. soft soap, or with 4 lb. lead arsenate paste or a preparation of barium fluosilicate and talc (4 : 1), both with 2 lb. gelatine, all in 100 gals. water, or dusted with the derris and China clay (1 : 9).

The following is taken from the authors' discussion and general conclusions: Dusting on 5th May to kill the ovipositing adults reduced infestation from 25 to 15 per cent.; the efficiency of the treatment was reduced by its having been applied when the trees were past full bloom and oviposition had begun, and by the heavy rain that fell within 2 hours. Although previous workers have considered that the eggs are vulnerable, if at all, only just before hatching [*cf. R.A.E.*, A **20** 580; **22** 425], applications of nicotine made before, during and after hatching reduced infestation by 81, 78 and 63 per cent., respectively. It may thus be possible to apply one spray at petal-fall or during the following week with good results. A trial showed that nicotine may be added to the lime-sulphur spray for scab [*cf.* **21** 557]. Nicotine applied before and during the penetration of the fruit by the larvae reduced infestation by 63–48 per cent. The derris spray was not markedly inferior to nicotine unless applied before hatching, when it reduced infestation only by 52 per cent. The greater toxicity of derris residues probably compensates for lack of ovicidal properties. Lead arsenate may reduce infestation if applied a week after petal-fall, when it is more likely to leave an effective deposit on the sides of the fruitlet, but is ineffective as a petal-fall spray unless combined with a fungicide (lime-sulphur or Bordeaux mixture), which either increases adhesiveness or is itself toxic. Barium fluosilicate did not give more than 20–30 per cent. control. Derris dust and spray and nicotine applied 18 days after petal-fall reduced damage by the migrating larvae by 36, 29 and 47 per cent. respectively. Various wetters and spreaders used are compared. The following figures show the yield in lb. of fruit of plots receiving the various treatments: nicotine, 728·7; derris (spray), 579·4; lead arsenate, 339·5; barium fluosilicate, 286; untreated 271·8.

Hey (G. L.) & Steer (W.). **Miscellaneous Observations on Apple Sawfly (*Hoplocampa testudinea* Klug) in 1933.**—*Rep. E. Malling Res. Sta. 1933* **21** pp. 234–242, 2 graphs, 10 refs. East Malling, Kent, May 1934.

Measurements of the width of the heads of larvae and adults of *Hoplocampa testudinea*, Klug, indicated that the females have 6 larval instars and the males 5. When applied on 30th May against the migrating larvae, some of which were found to be in the earlier instars, a derris dust protected apples more effectively than sprays of nicotine or derris and soap. None of the full-grown larvae penetrated below 9 ins. into the soil, and 89 per cent. constructed cocoons within 4 ins. of the surface. Varieties of apple flowering in mid-season were more susceptible to infestation than the early ones, but not much more than the late ones.

Hey (G. L.), Massee (A. M.) & Steer (W.). **An Experiment on the Control of the Apple Blossom Weevil** (*Anthonomus pomorum* **(L.) Curt.) by Means of a Derris Dust.**—*Rep. E. Malling Res. Sta. 1933* **21** pp. 217–219. East Malling, Kent, May 1934.

In the laboratory, adults of *Anthonomus pomorum*, L., that walked over twigs dusted with ground derris root, became paralysed. In field experiments in south-eastern England designed to prevent oviposition on apple and the subsequent "capping" of the blossoms, a proprietary derris dust containing 0·14–0·15 per cent. crude rotenone (or 0·13 per cent. re-crystallised rotenone) was applied either on 30th March, when the weevils were active after a short period of sunny weather, or on 7th April, when the trees were at the green-bud stage and oviposition was beginning, or on both dates. Counts in mid-May of the number of damaged blossoms out of 250 on one branch (or two where necessary) chosen at random on all 4 sides of 4 trees in the centre of each block (each treatment being duplicated) showed that injury was reduced from 31 to 13·1 per cent. on the trees receiving two applications and 15 per cent. on those receiving the late one only. The early dusting gave 28·4 per cent. injury, owing either to faulty timing, to inadequate deposit (due to lack of sufficent foliage to retain the dust and bad dusting conditions in one trial) or to rainfall soon after one treatment.

Greenslade (R. M.), Massee (A. M.) & Roach (W. A.). **A Progress Report on the Causes of Immunity to the Apple Woolly Aphis** (*Eriosoma lanigerum* **Hausmann**).—*Rep. E. Malling Res. Sta. 1933* **21** pp. 220–224, 1 fig., 9 refs. East Malling, Kent, May 1934.

Further experiments in feeding *Eriosoma lanigerum*, Hsm., on extracts of the bark of immune and susceptible varieties of apple [*cf. R.A.E.*, A **19** 636] suggested that the substance determining the degree of susceptibility is insoluble in alcohol but soluble in ether. Previous work on immunity is discussed from the literature, and the technique used in the present studies is described.

Greenslade (R. M.) & Massee (A. M.). **Some Notes on the Woolly Aphis Parasite** (*Aphelinus mali* **Hald.**).—*Rep. E. Malling Res. Sta. 1933* **21** pp. 225–227, 1 diagr., 3 refs. East Malling, Kent, May 1934.

In 1933, consignments of the woolly aphis [*Eriosoma lanigerum*, Hsm.] parasitised by *Aphelinus mali*, Hald., were liberated in two apple orchards in Kent where the Aphid had been abundant for many years. In one, into which it was introduced on two adjacent trees on 1st March, it became fairly well established and was found on 17th November on 129 out of 241 infested trees, having migrated against the prevailing wind and across rows free from infestation. It was apparently unaffected by sprays of tar distillate and lime-sulphur applied before and after its release, respectively. As the Aphid was completely eradicated from trees immediately surrounding the points of release, it seems probable that a more complete control might be achieved if liberations were made at a greater number of places. Though conditions were apparently favourable, *A. mali* failed to become established at the other centre, despite further liberations on 2nd September. The infestation became so severe that four sprays were applied between

April and August ; as two of these contained nicotine, they doubtless tended to check the parasite. Previous attempts to establish the Aphelinid in this county are noticed [*R.A.E.*, A **15** 56 ; **19** 638].

Hey (G. L.) & Massee (A. M.). **Tortrix Investigations in 1933.**—*Rep. E. Malling Res. Sta. 1933* **21** pp. 228–230. East Malling, Kent, May 1934.

Of 3,350 larvae collected in September on apples in the packing shed of a cold store in Kent, 85 per cent. were *Tortrix* (*Cacoecia*) *podana*, Scop., which occurred in the field on apple, pear, plum, damson, cherry, quince, walnut, raspberry, blackberry and hawthorn [*Crataegus*], 5 per cent. were *Eucosma* (*Spilonota*) *ocellana*, F., which was observed on the same food-plants with the exception of walnut, and 10 per cent. were *Batodes angustiorana*, Haw., to which all the damage was previously attributed [*R.A.E.*, A **21** 370]. The last-named Tortricid occurred in the field on apple, pear, plum and damson. Observations in several localities showed that from 2 to 34 per cent. of apples may be damaged by these larvae. The following Tortricids occasionally damaged fruit in the autumn: *T.* (*C.*) *lecheana*, L., which was obtained on apple, pear, cherry and walnut ; *Argyroploce variegana*, Hb., on the first three and hawthorn ; *T. diversana*, Hb., on apple, pear and privet ; *T.* (*Pandemis*) *ribeana*, Hb., and *Peronea contaminana*, Hb., on apple, pear, plum and hawthorn ; and *T.* (*Pandemis*) *heparana*, Schiff., on apple and pear only. A few examples of *T.* (*C.*) *sorbiana*, Hb., were bred from apple and of *Rhopobota* (*Acroclita*) *naevana*, Hb., from pear, and single individuals of *Pammene rhediella*, Clerck, *Peronea comparana*, Hb., and *T.* (*C.*) *rosana*, L., from apple, raspberry and black currant, respectively. Several examples of the Tineid, *Hemerophila* (*Anthophila*) *pariana*, Clerck, were reared from apple.

Hey (G. L.) & Massee (A. M.). **Observations on the Effects of various Gas Mixtures of known Composition on Tortrix Larvae in Store.**—*Rep. E. Malling Res. Sta. 1933* **21** pp. 231–233, 2 refs. East Malling, Kent, May 1934.

Various gases used for preserving apples in store were led from storage cabinets (in which the temperature was maintained at 37·5° F.) through air-tight tins (10 × 10 × 10 ins.) in which were placed smaller tins containing larvae of *Tortrix* (*Cacoecia*) *podana*, Scop., and a few apples, circular pieces of gauze soldered into the top and bottom permitting free diffusion of the gas. These small tins were removed for inspection at intervals varying from 7 to 71 days during September–December 1933. The results indicated that a mixture of 2·5 per cent. oxygen, 10 per cent. carbon dioxide and 87·5 per cent. nitrogen was the most successful in preventing damage by the larvae and was the most lethal to them. This was probably due to the low percentage of oxygen, the lack of which, if it did not kill them, rendered them sluggish and disinclined to feed. The sooner apples are placed in cold storage in a suitable gas mixture after picking, the less damage will be caused by Tortricids, all of which should be dead on the removal of the fruit after Christmas. Infested apples are attacked by soft brown rot, which may cause more severe injury than the actual feeding of the larvae.

Fisher (R. C.). **Defects in Timber caused by Pinhole Borers. How the Insects Work—an Attack on English Oak Boards—Investigations at Home and Abroad.**—*Timber Tr. J.* **126** no. 2970 pp. 281–282, 3 figs., 1 ref. London, 29th July 1933. [Recd. August 1934.]

As the larvae of pin-hole borers (Scolytids and Platypids) feed within the tunnels made in the green timber by the adults on the ambrosia fungus introduced by the latter, which requires moisture for its development, they do not, like those of *Lyctus* spp., attack seasoned wood. The presence of their galleries, however, which run across the grain of the sapwood and heartwood, may limit the value of a timber or render it useful only as a base for veneers or a core for ply-wood or for positions where appearance is unimportant. This type of injury, which has necessitated the grading of woods, is becoming increasingly important with the introduction of new timbers to the market. Signs of infestation are more prevalent in tropical timbers, but hardwoods (such as beech and oak) and occasionally softwoods grown in Britain may be attacked. Serious injury was found in late autumn in the heartwood of green boards of English oak that were piled too close to allow adequate circulation of air.

Injury may in general be reduced to a minimum by rapid extraction, prompt conversion and the stacking of timber so as to facilitate drying. In Britain, timber felled in winter is less likely to be attacked if it is converted within a short time than if it is allowed to lie in the woods or timber yards throughout the summer. Investigations at present being undertaken on pin-hole borers in various parts of the world are briefly discussed.

[Sakharov (N. L.), Ponomarenko (D. A.) & Pilyugina (O. A.).] **Сахаров (Н. Л.), Пономаренко (Д. А.) и Пилюгина (О. А.). The Dates of Sowing of Summer and Winter Wheat in Relation to Insect Pests.** [*In Russian.*]—*Grain Prod. J.* **3** no. 1 pp. 27–34, 1 graph, 2 refs. Saratov, 1934.

In view of proposals for irrigating extensive areas near the Volga, chiefly for the cultivation of wheat, experiments were carried out in the Republic of the Volga Germans and in the eastern part of the Saratov Government in 1932 and 1933 to study the effect of various dates of sowing on infestation of wheat by *Oscinella frit*, L. Wheat was sown on fallow plots on different dates in May and June and irrigated twice. Infestation by the fly increased considerably when the date of sowing was delayed, practically no grain being harvested from plots sown as late as 28th June. This was confirmed by observations in which wheat sown on different dates was exposed to infestation in field cages. The following conclusions are drawn : Under conditions of irrigation in the Steppe region, the microclimate, which is usually unfavourable for the fly, alters to such an extent that it causes damage. Infestation of the primary shoot at the time of the formation of two or three leaves does not kill the plant if it is irrigated when tillering begins, and injury to the primary shoot alone does not affect tillering and ear formation, but it reduces the yield of grain by 9·14 per cent. Infestation of the primary and one of the secondary shoots decreases the yield by 11 per cent. If only one secondary shoot is attacked, tillering increases [*cf. R.A.E.*, A **19** 284] and the formation of ears is not affected, but the

yield is reduced by 9 per cent. [*cf.* **19** 187]. The two-leaf phase is the critical period in the development of the plants ; if it coincides with active oviposition by the fly, which takes place at 18–30°C. [64·4–86°F.], a maximum number of shoots is attacked, whereas if it occurs at 8–16°C. [64·4–60·8°F.], the plant escapes infestation [*cf.* **19** 284]. In the eastern part of the Saratov Government, the wheat sown after 20th May was in the two-leaf phase when the first-generation flies were most numerous, and some of those of the overwintered generation were still present. It is concluded, therefore, that only wheat sown in April and the first half of May would be safeguarded from serious infestation.

Investigations under conditions of non-irrigated farming showed that early sowing reduces infestation of spring wheat and oats by *O. frit*, *Mayetiola destructor*, Say, and *Chaetocnema aridula*, Gyll. As regards autumn-sown wheat, experiments in the Saratov Government showed that the best time for sowing to avoid infestation by *Oscinella* or *Mayetiola* would be from 25th to 28th August.

[Ponomarenko (D. A.).] **Пономаренко (Д. А.). Contribution to the Organisation of a System of Measures against the Eurytomid, *Bruchophagus gibbus* Boh., a Pest of Lucerne Seeds.** [*In Russian.*] —*Grain Prod. J.* **3** no. 1 pp. 34–46, 10 refs. Saratov, 1934.

In the Republic of the Volga Germans, *Bruchophagus gibbus*, Boh. [*cf. R.A.E.*, A **21** 578] is responsible for a loss of from 1·6 to 71·5 per cent. of lucerne seed. Observations on the emergence of the adults from stored seed harvested at varying dates during the three preceding years showed that the larvae only hibernate in seeds of the autumn crop and only occur in those stored for not more than one winter. The adults emerge in the first half of the season following the harvest. The seeds of the summer crop are abandoned when they are still maturing on standing lucerne or soon after harvesting. When infested seed in barns [*cf.* **19** 369] was covered with layers of healthy seed of varying thickness, practically no adults emerged from under layers 1–2 ins. thick, and even a layer of only 1 cm. caused 75 per cent. mortality. For control, infested seed may be kept covered during May–July with seed from crops previous to that of the preceding autumn.

Experiments in sowing infested seeds showed that even a very superficial covering of soil prevents the emergence of 70–75 per cent. of the adults. None emerged from under a layer about 1 inch thick, except where the seeds had become exposed by cracks in the soil. There is therefore no need to use only uninfested seeds for sowing.

Maturing old lucerne of the first mowing was found to be the chief source of infestation of neighbouring plants that produced pods later. The females of the first generation of the Eurytomid migrate to seedlings or to old lucerne of the second crop, where they oviposit on young pods. Those of the second generation, which is on the wing at the end of the season, oviposit on the late pods of the plants on which they had emerged ; a great number of these pods drop to the ground during harvest and are left in the field throughout the winter, and in the spring the adults that emerge from them attack the old lucerne of the first crop. Experiments showed that this cycle of infestation may be broken by cultivating fields of lucerne of different dates of pod production about 1¼ miles apart, or by mowing for hay the old lucerne of the first crop in the beginning of the season following outbreaks of *P. gibbus* on seedlings and on old plants of the second crop ; in irrigated

areas, the two latter should be mown for hay when the seeds of the first crop have been heavily infested.

As the broken seeds and pods usually left about in the barn after threshing were found to harbour infestation, it is recommended that these should be removed and used as silage. The larvae that overwinter in fallen pods and seeds of seedling lucerne and of the old second crop may be effectively controlled by disking, so as to cover the infested pods with a layer of soil at least 1 in. thick. Standing lucerne left unharvested in the field offers favourable conditions for hibernation and should be burnt in early spring. Clover and wild leguminous plants in which *B. gibbus* breeds should be mown at the beginning of flowering within a radius of at least 1¼ mile from the lucerne fields, and cattle should be allowed to graze in the mown plots.

[Megalov (A. A.).] **Мегалов (А. А.). The Importance of** *Agapanthia dahli* **in Sunflower Cultivation and its Control.** [*In Russian.*]—*Grain Prod. J.* **3** no. 1 pp. 60–62, 1 fig., 5 refs. Saratov, 1934.

Investigation in the Lower Volga region on the bionomics and control of the Lamiids attacking sunflowers are summarised as follows: The species that is responsible for most of the damage is *Agapanthia dahli*, Richt. [*cf. R.A.E.*, A **19** 6]. The stems of plants in which the females have oviposited often break, and the feeding of the larvae lowers the yield of seeds and decreases their oil content. A Pteromalid, *Spintherus* sp., which destroyed about 20 per cent. of the eggs of this beetle, may exercise considerable control if present in numbers. Sowing sunflowers at other dates than usual would not safeguard them from infestation, owing to the length of adult life and of the oviposition period, which extends over the whole time of development of the plants. The measures recommended for control are ploughing the roots in to a depth of 6–10 ins. in autumn to destroy the hibernating larvae, which can only be done if the plants are cut close to the ground at harvest; digging out and burning the roots; and burning the stubble in the autumn or spring.

[Ponomarenko (D. A.).] **Пономаренко (Д. А.). Lucerne Seed Destroyers (***Tychius flavus* **Beck. et** *Tychius femoralis* **Bris.) in the Transvolga Region and their Control.** [*In Russian.*]—*Grain Prod. J.* **3** no. 2 pp. 38–57, 2 pls., 1 ref. Saratov, 1934.

A detailed account is given of the bionomics in the Transvolga steppes of the weevils, *Tychius flavus*, Beck., and *T. femoralis*, Bris., which have not previously been recorded as pests from the Russian Union. All stages are briefly described. The young adults of *T. flavus* emerge from the soil in spring and feed on the leaf-buds, stems and young shoots of old lucerne. Later, they concentrate almost exclusively on the flower-buds and flowers, which may wither and fall. They do not become sexually mature until they have fed for some time. At the beginning of oviposition, the number of eggs found in a female averaged 62; actually, however, more are laid, as new ones form throughout the oviposition period. They are laid exclusively in green pods, particularly those containing fully developed seeds, usually 1 or 2 in each and in the half nearer the base. Infested pods soon become indistinguishable from the others. Maximum oviposition takes place after the mass flowering of the old lucerne is over and is

completed about the time when most of the pods turn brown. Practically all the weevils then re-enter the soil, where most of them eventually die. A small number, however, of those in which the egg supply has not been exhausted, reappear during the flowering and pod formation of the seedling lucerne and oviposit on it. In the laboratory, the larvae hatched after 7–10 days. Each destroys 2–4 seeds or sometimes 5 or 6. They are full-grown at the time when the seeds are in the stage of waxy ripeness ; they then drop to the ground through an exit hole and pupate in the soil at a depth of about 2–4 ins., after a prepupal period of 8–10 days. The pupal stage lasts 6–10 days, but the adult weevils all remain in the pupal chambers throughout the autumn and winter. In one locality, over 16 were found to each sq. ft. of soil in the spring of 1931.

T. femoralis has a similar life-history but is considerably less abundant, only about 1 hibernating individual being found to a sq. ft. Before the formation of flower-buds, the adults feed chiefly on the stems of lucerne, seldom attacking the leaves, but sometimes also gnaw fully formed green pods. Sexual maturity and oviposition occur a few days earlier than in *T. flavus*, and the first eggs are laid in the ovaries of the opened flowers ; later eggs are deposited in the quite young flat pods with seeds only one-third of their ultimate size. Maximum oviposition coincides with the formation of pods on old lucerne, a smaller number of eggs being laid during the formation of pods on seedlings. Most of the weevils disappear at the end of June or beginning of July, and the last ones in the first half of August. The egg stage lasts 8–12 days. The larvae, which are full-grown by the time that the pods are completely formed and begin to turn yellow, pupate in the soil, and the pupae transform to adults a few days earlier than those of *T. flavus*.

It has been estimated that the feeding of the adults of these weevils causes about 21 per cent. of the total leaf surface of the infested lucerne to wither. Of the pods, about a third or even half are damaged annually by the larvae ; the loss in yield of seeds of old lucerne of the first crop varied in 1928–31 from about 16 to 55 per cent., and in that of seedling plants from 2·6 to 13 per cent.

It appears that only the larvae are attacked by natural enemies. The almost full-grown larvae of both species are often parasitised by the Pteromalid, *Habrocytus microgasteris*, Kurd., and to a less extent by *Eupelmus microzonus*, Först. The females of both these Chalcidoids oviposit in the infested pods, and the larvae feed externally on those of the weevils and eventually pupate inside the pods. Between them, they do not destroy more than 13 per cent. of the weevil larvae, the highest rate of parasitism occurring among those that attack seedling lucerne. The weevils are much more effectively controlled by ants, which carry away full-grown larvae when they drop to the ground ; in two fields in which there would otherwise have been 30–40 and 10–12 larvae, respectively, to 10 sq. ft. of soil, only 1–2 were actually found where ants were present.

In the laboratory, sprays of Paris green or sodium arsenite proved ineffective, but dusting with pure calcium arsenate killed all the weevils. When this dust was applied at the rate of about 14 lb. to the acre in a heavily infested plot early in the morning (but after the dew had dried) at the period of the maximum feeding of the weevils on the leaves of old lucerne, it killed about 95 per cent. Fumigation of the soil with paradichlorobenzene against the hibernating weevils gave very poor

results. No variety of lucerne markedly resistant to infestation was discovered. Where dusting is impracticable, it is advisable to mow the old lucerne for hay, leaving only the seedlings for seed production, as only a small percentage of the weevils then survive long enough to infest the latter. In irrigated fields, however, where the seed production of old lucerne of the first crop is very high, dusting with calcium arsenate would be essential. As wild lucerne growing in fallow land, along roads, etc., is readily attacked, it should be mown for hay and grazed over. Keys are given to the pests of lucerne in Russia based on the injury caused to the pods and the morphology of the larvae, and to the adults of the species of *Tychius* that attack lucerne in that country.

Ripley (L. B.) & Petty (B. K.). **Further Experiments on controlling Wattle Bagworm by Dusting.**—*Sci. Bull. Dep. Agric. S. Afr.* no. 131 pp. 3–17, 4 refs. Pretoria, 1934.

In further tests of dusts against *Acanthopsyche junodi*, Heyl., on wattle in South Africa [*cf. R.A.E.*, A **21** 35], reducing the dosage in the laboratory from 0·6 mg. per sq. cm. of leaf surface to 0·3, 0·15 and 0·074 mg. accentuated the differences in toxicity between the various materials. The dosage of natural cryolite required to give a mortality of 90 per cent. or over was 0·15 mg. per sq. cm. for the first instar, 0·3 mg. for the third and 0·6 mg. for the last two. Nearly complete mortality was obtained with these dosages after 24 hours, but with smaller dosages several days' exposure may be necessary. Mixtures of calcium arsenate or Paris green with natural cryolite had a degree of toxicity between those of the two ingredients, such mixtures proving of no advantage, but the incorporation of 7·3 per cent. paraffin oil with the cryolite gave very promising results. Electric sulphur applied to the bags constructed by the Psychid and to the foliage did not prove toxic, but a proprietary dust supposed to act as a contact insecticide gave 75 per cent. mortality and caused many of the larvae to leave their bags when applied at the rate of 0·6 mg. per sq. cm.

The results of the field trials with natural cryolite have already been noticed [**22** 352]. Although it proved only very slightly more toxic than synthetic cryolite in the laboratory, it was far more effective in the field, as it adheres better to foliage. Maximum mortality occurs 4–15 days after dusting. Paris green and calcium arsenate, which also proved promising, were rejected owing to their high cost, the injury caused to the foliage by the former, and the low toxicity of the latter to the older larvae. Barium and sodium fluosilicates did not adhere well, and the dust cloud of the latter proved unsatisfactory. Sodium ferric fluoride was abandoned, mainly owing to its high cost.

A method is described of correlating laboratory with field experiments by establishing a common basis of comparison between the amounts of dust applied to the foliage. Thus the application of 45 lb. per acre to trees of black wattle [*Acacia mollissima*] 25 ft. high represents roughly a deposit of 0·2 mg. per sq. cm. leaf surface [*cf.* **21** 385], whereas on trees only 2 ft. high it gives about 4 times as much dust on the foliage. It is pointed out that the relative efficiency of dusts in the field differs considerably from that in the laboratory, as under field conditions the adhesiveness and the nature of the dust cloud are often more important than toxicity itself. Dusting is not yet advised as a commercial control measure against *A. junodi*.

Ripley (L. B.), Petty (B. K.) & Hepburn (G. A.). **An Inquiry into the Method of controlling Wattle Bag-worm by Salt, as proposed by Henkel and Bayer.**—*Sci. Bull. Dep. Agric. S. Afr.* no. 131 pp. 18–24, 1 ref. Pretoria, 1934.

Investigations were undertaken in South Africa on the effect on the infestation of wattles by the bagworm [*Acanthopsyche junodi*, Heyl.] of applying salt (sodium chloride) at different seasons to various types of soil [*cf. R.A.E.*, A **20** 110; **21** 35]. Uninfested trees were artificially infested with about 300 larvae, and the percentage mortality and degree of infestation were recorded when the latter were full-grown. Examination of leaves from a large number of trees on each plot showed that the NaCl content of the foliage can generally be increased slightly (and sometimes considerably) by the application of 600 lb. to each acre of the surface soil. Larger quantities (up to 1,200 lb.) do not appear to cause any further increase. In sandy soils, the salt rapidly disappears from the upper few inches during rainy weather, after which the NaCl content of the new foliage soon returns to normal. It would be difficult to obtain an increase of salt in the foliage at any given time on a commercial scale, the time of increase depending largely on rainfall and the type of soil.

The application of sodium chloride apparently had no effect on the mortality of the larvae at any stage, on the degree of infestation or on the development or fecundity of the insects as judged by the weights of the pupae.

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Hapalia (*Pyrausta*) *machaeralis*, Wlk., and its form, *rubicundalis*, Warr., have been found infesting the shrub, *Callicarpa cana*, indicating that teak is not the natural food-plant of this Pyralid in Java.

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